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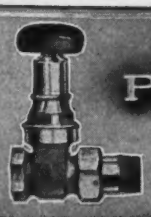
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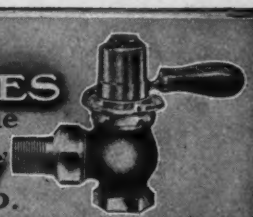

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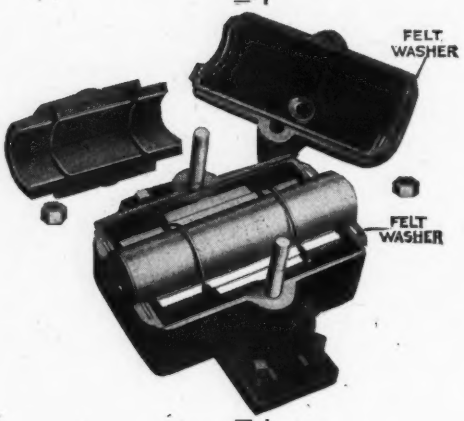

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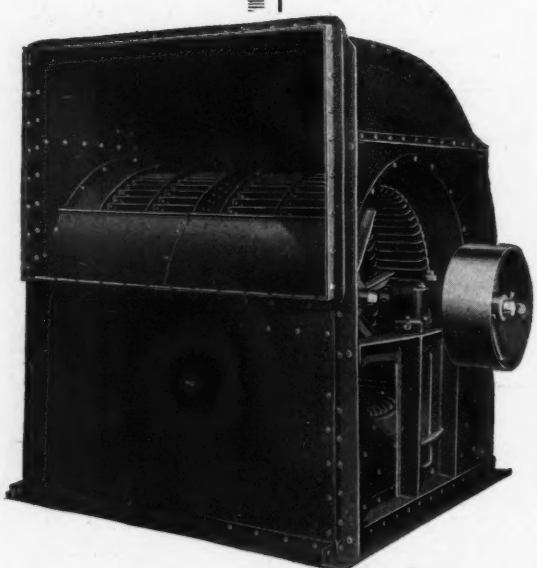

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THE HEATING AND VENTILATING MAGAZINE

Cooperstown, N. Y. September, 1918 1123 Broadway, New York

Burning Soft Coal in Heaters Designed for Hard Coal

With Suggestions for Selecting and Using Coal for House Heating Equipment.

In view of the fact that the middle western section of the country will only be able to obtain two-thirds as much anthracite coal for house-heating purposes as was used last winter, it is evident that a one-third deficit must be made up of bituminous coal from the mines of Illinois, Indiana and a small part of Kentucky.

There is special timeliness, therefore, in the suggestions that have been prepared by William H. Reid, smoke inspector of Chicago, which he recently promulgated under the title of "Suggestions for Fuel Conservation."

In selecting the coal Mr. Reid advises that the consumer should figure on purchasing at least 1½ tons of soft coal to be substituted for one ton of hard coal. The householder in buying soft coal for his bins, should select coal of the same size as the hard coal previously used. The size should not exceed 3-in. lumps.

FIRING SOFT COAL.

Soft coal, continues the statement, is a freer burning fuel on account of the gas it contains. For this reason hard and soft coals exhibit different characteristics when burning and should not be fired in the same way. Bituminous coal can be fired by placing the fresh charge on one side of the grate only, leaving a part of the surface of the fuel bed uncovered. The volatile matter arising from the freshly-fired coal is ignited by the red hot coal on the uncovered part of the fire and a large part of it burns in this way. This is called the coking method and is commonly used in firing square or rectangular fireboxes. The fresh coal is placed at the front end of the grate and the live coal pushed to the back part of the grate, replacing it with fresh coal in front, as the requirements demand. This process is repeated when the next charge of coal is added.

Another method successfully followed with circular grates, is that of placing the fresh charge of coal directly in the center of the grate and building up a pile in the shape of a pyramid with successive charges of fresh fuel. This method permits the coal to coke slowly and insures a mixture of the volatile smoke and gases which pass off from the fresh fuel with the hot gases from the coked coal burning at the edge of the firebox. This permits complete combustion with greater heat generation.

If the entire surface of the fuel bed, when burning bituminous coal, is covered with a heavy charge, the volatile matter from the fresh coal does not ignite for a considerable length of time after firing, and passes away unburned as tarry greenish-yellow smoke. The furnace and flues become filled with

smoke and when the fire finally works its way through the fresh layer of coal, the smoke and gas may ignite with an explosion violent enough to cause damage. These explosions are more likely to happen with the finer grades of coal. Fine coal should be wet just before firing to prevent its being carried into the flues and chimney, also to prevent waste of this fuel by sifting through the grates.

The first mentioned methods of firing reduce the amount of soot deposited in the flues so that less frequent cleaning is necessary. They also economize the coal by reducing the heat losses from incomplete combustion and allow the heat to be transferred to the boiler direct. To attempt to burn anthracite coal from the side only does not work out successfully. It is necessary to spread this kind of fuel completely over the bed of live fire. Anthracite fires should be disturbed as little as possible.

On account of the characteristics exhibited in burning soft coal in house-heating equipment, it may be advisable during the mild weather to burn soft coal exclusively or else increase the proportion of this grade of the mixture. This will enable the householder to save the hard coal for the severe winter weather when the demands on the furnace are greatest. The two fuels can be mixed before firing or the soft coal can be thrown on the fire first and then covered with a layer of hard coal. Both methods have been employed successfully.

Fires should not be disturbed excessively and should be poked only enough to break up clinkers or coked coal. Ashes should be removed by shaking the grates and this should be done only enough to keep the fire clean and clear of ash; care should be taken not to lose good live coal in the operation. A thin bed of ash on the grates in moderate weather may prove economical, preventing the coal from burning up too fast. The ash pit should be cleaned out every day and ash not allowed to accumulate, as it interferes with the draft, sometimes causing the grates to burn up if allowed to clog the ash-pit, cutting off the air supply.

Air admitted over the fire is quite as essential to combustion of bituminous coal as the fuel itself, as it is necessary for the perfect combustion of the coal. A supply of air in large quantities is needed immediately after firing and this can be admitted by leaving the door above the fuel bed slightly ajar after each firing. When the volatile matter has been driven off the coal, the air supply through the door can be cut off. For this reason the burning of bituminous coal requires more careful attention and expert firing than hard coal or Pocahontas coal.

STARTING A NEW FIRE.

At the beginning of the heating season, before starting fires, see that the ash-pit, grates, tubes, and all gas passages, are clean, including connection between boiler and chimney. The precaution regarding cleaning of smoke pipe between boiler and chimney, should be rigidly observed, as there is danger of fire if soot is allowed to accumulate in this passage. If the proper cleaning of the flues and chimney is neglected, objectionable gases are generated in the furnace which find an exit through the fire door, filling the basement with smoke which arises to the living rooms above, creating serious as well as objectionable nuisance. It is especially important to have the boiler in a thoroughly clean condition as the bituminous or soft coals are smoky and cover the flue surfaces with a large amount of soot and tar which reduces the transfer of heat and impairs the draft.

Dampers should be adjusted so that they open and close properly and do not interfere with the draft in the chimney. It is very important that the ash-pit should be tight and the damper in the ash-pit door adjusted so that the minimum opening required to properly burn

the fuel may be obtained. This damper should fit so that no air is admitted to the ash-pit when it is closed.

After banking fires, do not close the stack damper tight as the gas accumulates in the furnace and has no exit except through the firing doors, causing an accumulation of gas in the basement.

FINALLY:

Never fully close the damper in chimney connection.

Never let tubes, gas passes or smoke pipe become dirty.

Never leave clean-out door at bottom of chimney open.

Never make openings in the chimney for ventilating purposes.

Burning Bituminous Coal in House-Heating Boilers

By W. A. PITTSFORD.

(From an address delivered at the Thirteenth Annual Convention of the Smoke Prevention Association, Newark, N. J., August 22, 1918.)

Regardless of what anyone may say, it requires more air in a given time to burn bituminous coal, than it does to burn the semi-bituminous coals that have commonly been used in the heating furnaces, that is to say, that at the moment of firing a great deal more air is necessary with a free-burning coal. After the volatile matter leaves the fuel bed, the carbon content of the fire is about the same with all coals, and requires practically the same air. The difficulty arises in the low-pressure heating of getting the combustion from the green fuels complete enough so that the tarry substances which form the soot do not adhere so rapidly to the boiler flues and surfaces, as to further close them up and stop the burning of the fuel.

GASES FLOW IN STRATIFIED STREAMS.

Gases in a furnace are not of uniform composition. They tend to flow through the combustion spaces in stratified streams. This tendency of stratification retards combustion, and is more prolific in hand-fired furnaces than in stokers.

Volatile matter leaves the fuel bed as complex, hydro-carbon compounds. In the absence of sufficient oxygen for their complete combustion, these hydro-carbons are quickly decomposed by the high furnace temperatures into soot, hydrogen and the carbon-monoxides. The formation of CO is due to the presence of CO_2 and the small supply of oyxgen. At a distance of 12 to 15 in. from the surface of the fuel bed only a very small amount of hydro-carbons can be found in any state, gaseous, liquid or solid. The solid substance present in flames is mostly soot with a trace of tar. All hydro-carbons are unstable at furnace temperatures, and unless enough air to insure complete combustion is quickly mixed with them at the time they are distilled, they are quickly decomposed, the remaining product consisting of soot.

Soot is formed at the surface of the fuel bed by heating the hydro-carbons in the absence of air, and it is not formed by the hydro-carbon gases striking the cooling surface of the boiler. As a matter of fact, only a very small trace of the hydrocarbon gases ever reach the surface of the boiler. The hydro-carbons that do so are prevented from decomposing by the cooling effect of this contact. The cooling

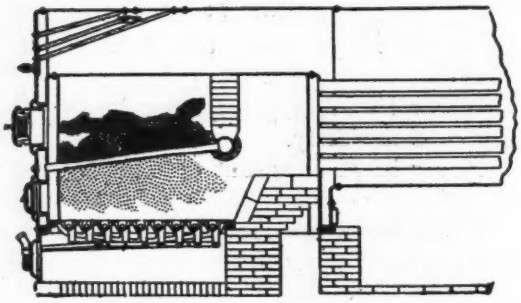

FIG 1.—STARTING A FIRE IN A DOWN-DRAFT BOILER.
Kindling is placed on the upper grate and lighted. The ash-pitdoor and the middle door are closed, and the draft door in the upper door left open.

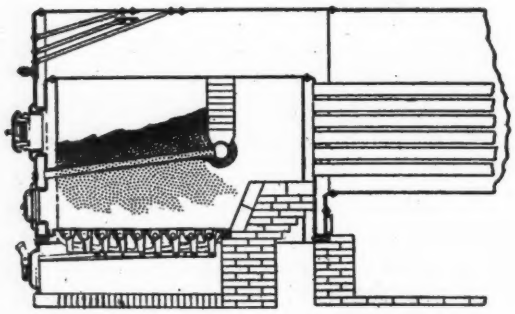

FIG. 2.—CONDITION OF FUEL BED AS BURNING PROGRESSES.
Draft door at top still remains open.

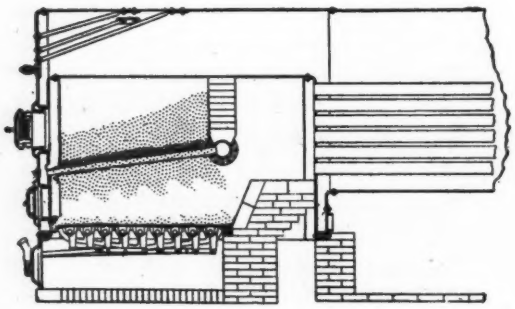

FIG. 3.—ENTIRE FUEL BED IGNITED.
Steam pressure is up and regulator has closed draft damper in top door.

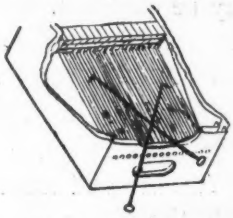

FIG. 4.—METHOD OF PREPARING FIRE FOR FRESH SUPPLY OF COAL.
One poker is used, the illustration showing the angles at which it should go under fire on top grate.

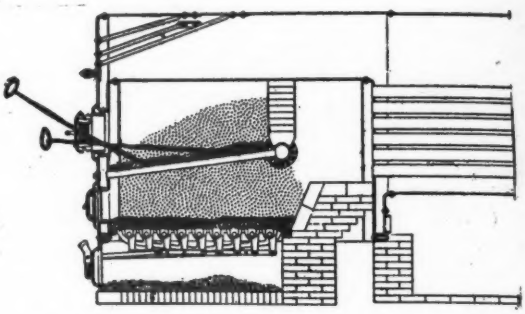

FIG. 5.—ANOTHER VIEW OF POKER GOING UNDER FIRE.
Showing way poker should go into door and shove along over top of grates back to end of grate.

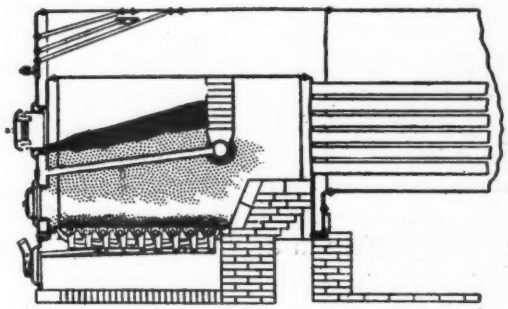

FIG. 6.—SAME FIRE WITH FRESH FUEL ADDED.
Air should now be admitted through bottom ash pit door to burn fuel on bottom grate.

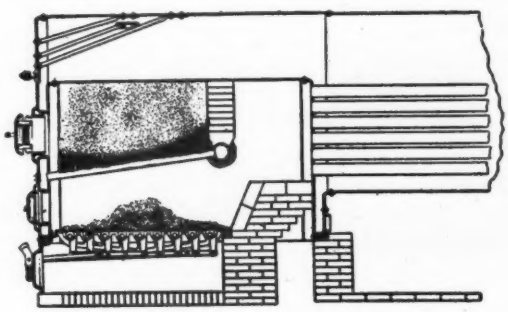

FIG. 7.—BAD CONDITION OF FIRE OFTEN FOUND.
Black portion on upper grate is clinker.

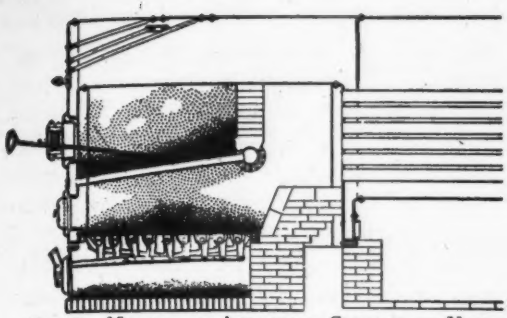

FIG. 8.—MANNER OF ATTACKING CLINKER ON UPPER GRATE.
Back portion of grate should be cleaned first.

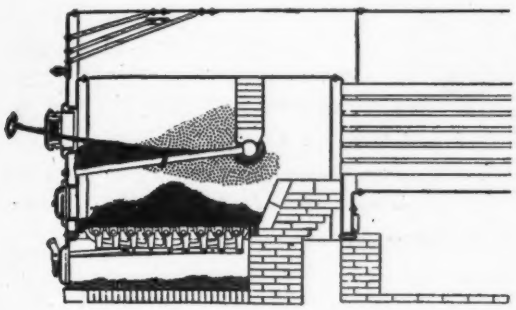

FIG. 9.—REAR OF FIRE CLEANED OUT AND FUEL PUSHED OFF FRONT PORTION.

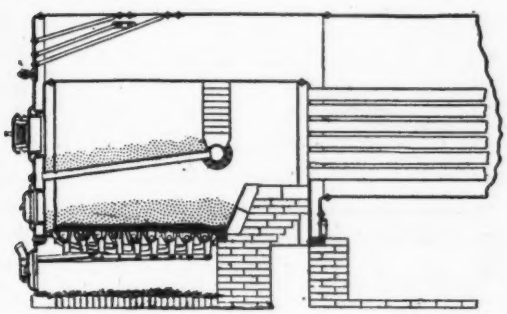

FIG. 10.—FIRE CLEANED, READY FOR FRESH FUEL.

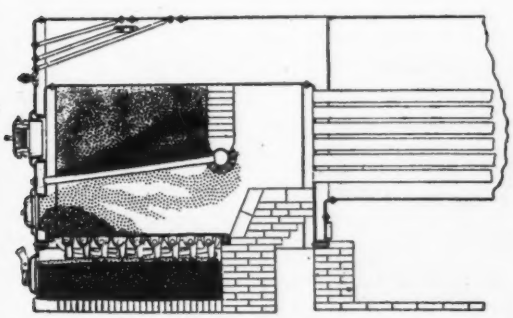

FIG. 11.—ANOTHER PREVAILING METHOD OF IMPROPER FIRING.
Front portion of upper grate bare, back portion covered with clinker.

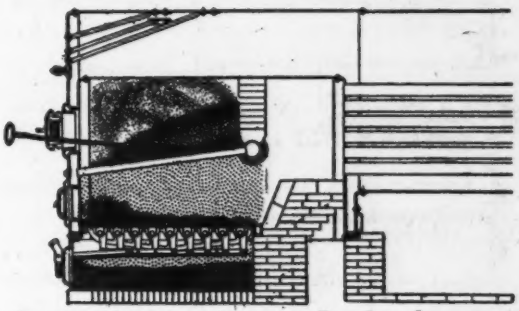

FIG. 12.—METHOD OF ATTACKING BAD CASE SHOWN IN FIG 11.

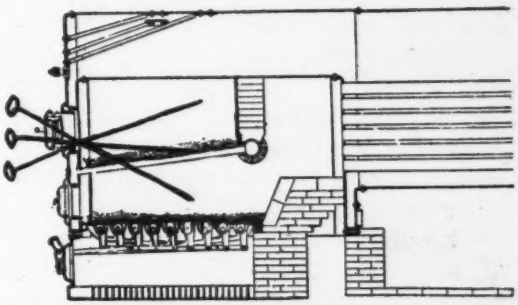

FIG. 13.—IMPROPER METHOD OF USING POKER ON DOWN-DRAFT GRATES.
This method breaks up fire and makes holes in fuel bed.

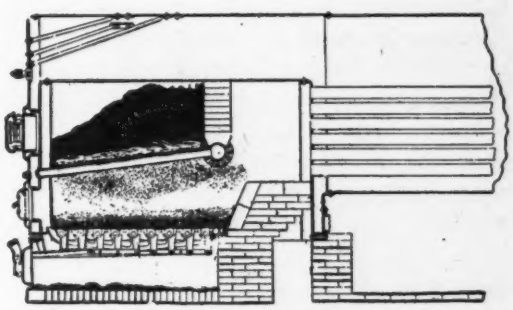

FIG. 14.—FIRE BANKED IN PROPER MANNER.
Top door is shut by disconnecting regulator. Bottom ash-pit door openings left open.

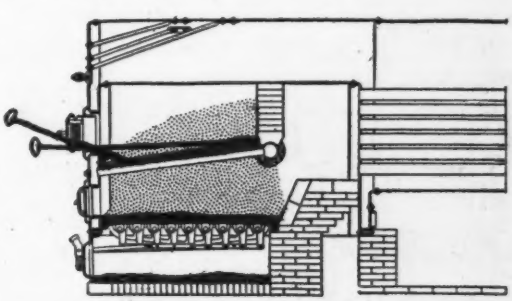

FIG. 15.—CONDITION IN MORNING WHEN BANKED FIRE IS BROKEN.
Poker to be used in manner shown, after ash accumulation is shaken into ash-pit.

surfaces do not cause the formation of soot; they merely collect soot and prevent its combustion.

THE MIXING OF OXYGEN WITH THE COMBUSTIBLE THE IMPORTANT FACTOR

The rapidity of burning combustibles in the combustion spaces depends on the quantity of oxygen intimately *mixed* with the combustible. The larger this quantity, the faster the combustible burns. Thorough *mixing* of the gases produces uniform mixture of the oxygen and combustible, thereby making possible the most rapid combustion with any given air supply. In many instances the rapidity of combustion is limited by the rate of mixing, and *mixing* is a very important factor in the attainment of complete combustion.

This means that in a heating boiler of the straight draft or updraft type, and using bituminous fuels, it is necessary when firing to leave a portion of the live, bright fire uncovered (this will not in these small units obtain complete combustion, but it will insure a better combustion) and in doing this you will necessarily force a better air mixture, a decreased supply of distillation, and with the low chimneys and low drafts that are always present in connection with heating furnaces, it will have a tendency to eliminate a portion, at least 40%, of the smoke and soot that otherwise would have been made and wasted. If the furnace is of such a design that some kind of an arch can be placed in it for a mixing effect, and the drafts are sufficient to take care of the load on the unit, then you can get complete combustion in this type of furnace. If the furnace can use an arch, then the other things necessary to its use must be changed so that the arch will be successful.

COAL SHOULD NOT BE LARGER THAN HEN'S EGGS.

Never fire large lumps of coal. They should never be larger than a hen's egg. In this way you will have a more even fuel bed, better distillation and better economy. You must break up the big lumps.

You cannot expect as good results with this changed condition and bituminous coal as you formerly had with hard coal or coke. You must expect to do more work, to attend to your fires more often and to be more particular with your fires in order to save a portion of the heat of this bituminous coal that you would otherwise have wasted, and in this connection we would suggest that the man who tends your furnace be given more money to do this work. If he was worth a certain price when coal was one-half the price it is now per ton, he should be worth more money when the price per ton is doubled, and the conditions are so unfavorable for operation.

WHY DOWN-DRAFT BOILERS ARE SMOKELESS.

Down-draft boilers are known in the heating world as smokeless boilers, and they are boilers equipped with a down-draft furnace. The furnace is what may be called a two-story affair, having two fire-grates, one above another. The upper is composed of pipes or other metal in which water circulates, and is a part of the boiler. The lower grate is an ordinary shaking or straight grate. The fire is on the upper or water grate and burns downward. The reason why this furnace is smokeless with all kinds of fuel is because the distillation of the green fuel must pass through an incandescent fuel bed of a very high temperature.

In the preceeding remarks on straight-draft furnaces, we dwelt on the fact that more free oxygen is needed at the time of firing than after the volatile gases are distilled off. Certain conditions in this down-draft furnace have worked out the very principles that we spoke of in the up-draft furnace. That is to say, when the green fuel is put on the incandescent fuel bed and the draft is down, the intimate mixture of the

free oxygen down through the fire with the distillation passing through the fuel bed at the same instant combined with the high temperature of this fuel bed, forms complete combustion, and the rapidity of this combustion is governed by the amount of air allowed to pass through. If properly fired there can be no smoke. In the straight-draft furnace, it is absolutely necessary that the proper firing method be used to obtain the results desired. Likewise, in the down draft furnace the proper method of operation must be used to obtain the desired results.

NOTES ON USE OF SLICE BAR.

In a straight-grate furnace it is improper to use a slice bar and stir the incandescent fire, green coal and ash up together. Likewise, it is improper to do the same thing on a down-draft furnace. It is improper to do this with any type of furnace that man ever saw, and if people who have been using the very high carbon coals must use the high volatile coal, will give some attention to the proper methods of operation in the old type of furnace, they will not experience serious trouble in heating their buildings. They must not expect 100% efficiency from a furnace that is made to burn hard coal and coke when the subject it to the ordinary bituminous coals. They should not expect 100% efficiency from one in which they have placed an arch without attention.

From the beginning of time, all writers on combustion of coal and how to burn it, have always stated that to burn bituminous coal smokelessly and efficiently, it is necessary that the air be intimately mixed with the distillation of burning fuel at a high temperature, and many designs of hand-fired furnaces have been made to accomplish this result, nearly all of which had some feature about them that required a special addition constructed with the furnace to obtain a partial result of what they were designed to do.

DOWN-DRAFT CONSTRUCTION NEAREST APPROACH TO IDEAL FOR SMOKELESS COMBUSTION.

The man who perfected the down-draft furnace came nearer accomplishing this result than any other hand-fired furnace made. The fresh fuel is always placed upon a fuel bed from 4 to 10 in. deep. The draft admitted to this fire is through a door that is open to the atmosphere, the cold air passing through the green coal. As the coal is burning, the fresh air mixes intimately with the thousands of streams that are going through the hot fuel bed, giving you an intimate mixture that is not found in any other type of furnace in the world. If the furnace is built properly, with a proper boiler setting and a proper chimney to do the work that the boiler is called upon to do, there is no furnace in the world that will give you as near complete combustion as the down-draft furnace.

Plain Talk on Chimneys

By E. C. LILLIE,
City Smoke Inspector, Denver, Colo.

The most important thing in house heating is the very thing that receives the least attention, and that is the chimney; and 99 out of 100 are far from right.

The failure of the chimney to "evolute" is incomprehensible, but I suppose it is another case of the "calf path" that determined the location of the beautiful streets of Boston. You spend

weeks looking for a boiler while the builder is putting up a chimney that makes the use of a good boiler absolutely impossible. The height, shape, location, temperature and manner of construction govern the intensity of draft, while the area governs the volume of gases transmitted.

An excess of area is a poor substitute for lack of intensity and the lack of either one results in incomplete combustion or the use of higher-priced coal. Many chimneys of sufficient height and area are rank failures owing to loose construction, causing infiltration of air and checking of the draft. Talk about coal conservation! Were all the coal wasted during the last ten years because of poor chimneys now available, every mine in the country could shut down for a year and we would suffer no inconvenience and still the word chimney does not appear in our published rules to conserve coal.

Draft is not a suction, it is a case of push, pure and simple. While the pressure in the stack is slightly below atmospheric, it is so because of rarification due to expansion, which is in turn due to temperature.

VACUUM ARGUMENT MISLEADING.

The vacuum argument is misleading.

To illustrate. Assume a chimney containing 40 cu. ft. of air at 60° F. weighing about 3 lbs. Tightly close the chimney at the bottom, heat the air to 550°, causing it to expand until nearly one-half of the air runs over the top. Now the chimney is still full of air, but owing to the flow over the top the 40 cu. ft. now weighs but 1 6/10 lbs. On the outside of the chimney there are columns of 60° air weighing 3 lbs., the same as the air in the chimney before we heated it.

Now suddenly open the bottom of the chimney and we get the same result as we would with a balance with 1 6/10 lbs. on one end and 3 lbs. on the other. The 3 lbs. of cold air rushes in and pushes the 1 6/10 lbs. of hot air out of the chimney and thus the phenomenon we call draft is put in motion, and continues in motion as long as hot air or gases are supplied to it by a fire in the boiler or furnace. The outside air is the motive power, but if you shut up your boiler room so that the air cannot get in it cannot do the work. A 100-H. P. boiler requires about 150,000 cu. ft. of air per hour, or 2,500 cu. ft. per minute, and it cannot get in through a keyhole.

Water currents, air currents or gas currents take the way of least resistance, so if you have any cracks or openings through the side of your chimney the air is going through those and not through your fuel bed.

HOW TO BUILD CHIMNIES

Avoid this trouble by a sane type of construction. Lay the foundation of the chimney and place on it a round fire-clay flue lining, lay the brick up around it to the top of the lining. Then place another length of tile and lay the brick up, etc. Many of you have done this and been disappointed in the draft because the tile does not make a perfect joint and air leaks in; therefore, as soon as you get the brick up to the top of each joint prepare a batch of thin mortar containing a liberal percentage of cement and pour it in between the tile and brick till full; smooth up the joint inside and you have a chimney that is worth while, provided it is of proper size, height, location and straight from top to bottom. Size, 10 in. round for small houses, 12 in. round for eight or ten-room, and 15 in. round for larger. Why round? Because it is better, regardless of the opinion of your bricklayer.

Height.—As high as your wife or your architect will let you build it—thirty, forty or fifty feet above the grate.

Location—If you cannot build a house large enough to have room for a chimney, cut out building till you can, for you owe something to posterity. I

know of nothing that will make them go wrong quicker than a draftless chimney.

We have a lot of tight-wad chimnies. In the effort to save a little space they stick them in an outside wall, run up through the lower edge of the roof and then blow about the architectural effect. Everybody is doing it. It is the style, like high heels, open fronts, etc., but if there breathes a man who is not fond of seeing things exposed to the weather, let him so locate the chimney that it can go straight up and emerge from the roof at its highest point, thus securing a good draft at all times. To place them at any other place and be free from contrary air currents they must extend so far above the roof as to be dangerous.

Offsets, contractions, etc. all restrict the velocities of the gases and should be avoided even to get around fireplaces. Why do I dwell so long on chimneys? Because they absolutely limit the possible efficiency of your heating plant and are the prime factor in the size of your coal bill.

Remodeling a Candy Factory Plant to Reduce Condensation Losses

How Economies were Effected by Grouping Units According to the Temperatures Required.

The subject of how to take care of the returns and drips from steam apparatus and steam lines which are operated at different pressures is a fertile one for discussion. In many plants it has been the custom to discharge these returns into a common return line or receiver tank where a large portion is vaporized either in the return itself or after entering the vented tank into which the return line is connected. From this open tank they may be pumped directly into the boilers or allowed to flow into an open feedwater heater where they are re-heated. The increasing attention being given to obtain greater efficiency, the conservation of B. T. U. and the rising price of coal all combine to render a discussion of this subject a most profitable one. Is it, or is it not, correct to take care of such returns in this manner?

William H. Rose in a recent number of *The Sanitary Engineer* discusses this matter in relation to one particular plant although he states that "an examination of the conditions existing, the changes adopted and the results arrived at in any one plant may be taken as applying in the general way, with slight modifications subject to local conditions, to them all."

OPERATING CONDITIONS

The example cited is that of a candy factory upon which a complete record of facts and figures was obtained. In this plant the motive power is electrical and the entire output of the boilers goes to furnish heat for cooking, drying and heating in the factory. The industrial operations require steam at varying pressures so as to obtain temperatures ranging from 320° F. down to 215° which means pressures running from 110 lbs. (gauge) maximum down to about 2 lbs. minimum. The plant is supplied by three 150-H.P. H. R. T. boilers, coal-fired and operating at 115 lbs. The steam is piped directly from the boilers to the various apparatus. The condensate is drained through a variety of thermostatic, float and bucket traps, all of which discharge through return lines into an open receiver in the boiler

room from which point the water is pumped into the boiler by a duplex steam pump.

Investigation showed a vent pipe discharging into the air (from the open receiver) which gave out a considerable amount of steam and vapor at all times. To keep down this amount of steam a stream of cold water was kept running into the receiver because it was stated the water came too hot to pump. This, of course, provided a superfluous amount of water which overflowed into the drain. The average temperature of the feed-water to the boiler was between 170° and 180°, whereas the returns averaged around 212° showing a direct loss of 37° between the receivers and the boilers.

The loss of water by actual measurement approximated 6½ gals. per minute which was a continuous loss while the boilers were in operation and represented over 1,000,000 gals. a year. The water came from the city mains at a temperature of about 45° F. while the overflow went into the drains at about 175°, thus carrying away heat to the extent of over 7000 B. T. U. per minute. This is equivalent to throwing away the B. T. U. obtained from almost a pound of coal or a loss of 60 lbs. per hour, or 600 lbs. per day.

The feed pump was operated continuously, and, at an average consumption of about 3% of the boiler power, used some 400 lbs. of steam per hour which, at an evaporation rate of 4 lbs. of coal per horsepower, is represented as 54 lbs. of coal per hour, or 540 lbs. per day. The steam was conducted to some of the apparatus at a pressure of 110 lbs. and was there condensed, this condensation occurring at 344°. Thus, when the condensation was allowed to cool down to 175° before it got back to the boilers it lost heat to the extent of 169 B. T. U. per pound, or approximately 17% of the heat necessary to make the steam. This can be checked by the fact that for every 10° increase in the feed-water temperature the fuel is reduced 1%. The amount of vapor lost through the vent pipe and by other means could not be accurately determined but was considerable. To avoid these losses the following scheme was adopted:

CHANGES MADE TO REDUCE LOSSES.

(a) Different units were separated into groups according to the temperatures required.

(b) The steam was taken direct from the boilers to the groups requiring the highest temperatures; i. e., full boiler pressure.

(c) After passing through these units the return condensate was taken through a swing check valve to a closed receiver.

(d) A drain line was run from the bottom of the receiver direct to the boilers, entering the boilers through a direct boiler-feeder which resulted in putting the water back into the boilers at about 300°.

(e) A vent pipe was taken from the top of the receiver, this collecting all the vapor and condensate which flashed back to steam due to the low pressure and conducting this lower pressure steam to the next apparatus requiring a lower temperature where the steam was used a second time.

The results obtained showed a saving of 1,000,000 gals. of water per year and approximately 564 tons of coal. There was also a marked increase in the quantity of material turned out and a big reduction in the time taken to complete the cooking process. The plant could be operated with two boilers instead of the three that were formerly required. The total cost of the re-arrangement of the piping approximated $1,000 while the water and fuel saving, taking water at 10c. per 1,000 gals. and coal at $4.00 a ton, amounted to $2,369.

HOW THE SIZES AND CAPACITIES OF THE BOILER-FEEDERS WERE FIGURED.

In figuring out the sizes and capacities

of the different boiler-feeders they were approximated as follows:

The main boiler-feeder was arranged to have a capacity equal to the total horsepower developed at the boilers with a 50% reserve capacity. The high-pressure cooking units were estimated at about half the boiler load; the intermediate pressures at 30% and the low pressures at 20%. On this basis the losses and saving resulting from the changes work out as follows:

Boilers developed 450 H. P. which (at 30 lbs. of water per horse-power per hour) is 13,500 gals. of water evaporated; at 115 lbs. steam pressure the evaporation temperature is 347° and the latent heat of evaporation is 872 B.T.U. Thus the total heat of the steam is 1191 B. T. U. with feed water at 175° containing 143 B. T. U. To evaporate a pound of water into steam under these conditions requires the heat exchange equal to the difference of the two, or 1048 B. T. U. If a pound of coal gives 14,500 B. T. U. at 65% efficiency, each pound gives 9400 B. T. U. available and each pound of coal will evaporate 9400/1048 or 9 lbs. of water per pound of coal. Under the changed conditions about half of the water passed directly back to the boilers at 324° which, to evaporate into steam again at 115 lbs., requires only 897 B. T. U., or a saving of 151 B. T. U. per pound which is 15% on half the plant capacity. The 30% return came back at an average pressure of 60 lbs. and went direct to the boiler at about 300° or a saving of 12% on 30% of the plant. The low-pressure steam was returned at about 200° giving 2½% saving or a complete saving on the plant of

$$\begin{aligned} 50 \times 15\% &= 750 \\ 30 \times 12\% &= 360 \\ 20 \times 2.5\% &= 50 \\ \hline & 1160/100 \end{aligned}$$

or a saving of 11.6% on the entire plant. This is on the temperature of the returns alone. In addition the reduction of steam demands caused by the elimination of the boiler-feed pump, using 3% to 5% of the total boiler steam, and the cutting out of the open vents on the system, it was estimated, reduced the boiler load and consequently the coal consumption at least 25%.

Savings Possible in Large Hot Water Heating Systems

Practical suggestions for effecting economies in the operation of large hot-water heating plants are made by the Public Policy Committee of the National District Heating Association. The suggestions are intended more particularly for central station heating work, but apply with equal force to any plant of considerable size:

With most hot water heating companies it has not been customary to reduce the schedule of heat temperatures at which the hot water is sent out from the station during the night hours and during the day when the sun is shining brightly. Inasmuch as most people prefer to have their houses cooler during the night than during the day, and in view of the custom of sleeping with windows open, it was thought advisable by one central heating station to reduce its schedule during the night hours during the past winter with the idea of conserving fuel. It was found by making the trial that the schedule at which hot water was sent out from the station could be reduced 10 degrees during the hours from 9 p. m. to 4 a. m. without any complaint from heating customers.

The reduced schedule resulted in a saving of 9,000 B. T. U. per 1000 lbs. of water circulated. This shows that during the period of seven hours per day in February, 1918, a saving of 22% of the B. T. U. supplied under the normal schedule was effected.

Also, it was further thought that a conservation of fuel by reducing the temperature of the water leaving the station during certain hours of the day when the sun was shining brightly might be effected. Experiments in this connection demonstrated that it was perfectly possible to send water out from the station at a temperature of ten degrees below the normal schedule between the hours of 9 a. m. and 4 p. m. on days when the sun was shining brightly without any complaints being received from heating customers. The effect of this reduction of temperature in the water sent out from the hot water heating station is similar to that effected by the ten degree reduction of the night schedule.

A great many buildings keep their steam heat on uninterruptedly during the twenty-four hours, and, in fact, some people are inclined to believe it to be the most economical way to operate a heating system. This, states the committee, is one of the popular fallacies which has perhaps been fostered by engineers who do not like the extra labor of pushing the fires in the morning hours. An example of what can be saved by careful manipulation of the valves is the Edison Building in Chicago, which last year had separate pipes run to certain offices which were kept open for the telephone operators and the load dispatcher's office all night long, and the balance of the building was turned off at night, leaving steam turned on in only 2% of the offices. The following tabulation will show the average mean temperatures in the winter months during the past winter and also during the winter before; the steam consumption during the corresponding months and the resultant number of hours of heating on account of the new method of handling the steam valves:

As will be seen, although the average temperature last winter was slightly lower than the winter before, there was a saving of about 25% in the steam consumption. This 25% saving was made without any appreciable discomfort to the occupants of the building. This same idea could probably be applied, with some modification, to residence heating.

In the report of this committee last year, reference was made to the enormous saving which could be made by adopting a lower average temperature for interiors than that commonly used, namely 68° to 70° F. This point has been emphasized during the past year by various government officials who have had charge of the conservation of coal. Articles by well-known physicians have been along similar lines, and while no definite action has been taken thus far, the general sentiment toward the maintenance of cooler interiors has undoubtedly increased.

	Mean Temperature		Steam Consumption		Hours Heating	
	1916-17	1917-18	1916-17	1917-18	1916-17	1917-18
	Deg. F.		Pounds			
October	54.4	45.0	4,424,000	3,261,000	491	405
November	43.2	32.0	6,175,000	4,065,000	592	354
December	26.0	22.4	8,751,000	7,515,000	730	450
January	24.2	13.3	7,985,000	7,470,000	737	380
February	19.8	27.2	6,842,000	4,853,000	672	302
March	38.8	42.2	4,953,000	3,859,000	599	297
April	44.8	44.0	3,769,000	2,776,000	570	278
May	52.6	63.7	2,443,000	305,000	490	31
Total			45,342,000	34,104,000	4,881	2,497
Average	38.0	37.6				
Reduction				25%		49%

CHICAGO COMMISSION ON VENTILATION

School Building Heating and Ventilation

By SAMUEL R. LEWIS

II

In the light of the foregoing observations, let us describe a school-house heating and ventilating system in which they are more or less intelligently embodied.

BOILERS.

These are in an outside fireproof boiler-house, and are capable of burning bituminous coal without smoke, carrying, say, 30 lbs. working pressure. They are steel encased, to prevent air infiltration. They are arranged so that at least 80% of the time there is a spare unit which can be shut down for cleaning or repairs. They have automatic high and low water alarms, and all other fittings as approved by the best engineering authorities.

ENGINES.

These are adjacent to the boilers and in a part of the boiler-house, but in a room free from coal and ash dust, while still under the observation of the fireman. They comprise fan engines, vacuum pumping and boiler-feed pumping engines, and a steam-driven air compressor. Steam power may be used also for driving air washer circulating pumps, hot-water circulating pumps, vacuum cleaners or any other power requirement. So long as there is any demand for heat, the power is very largely a by-product. These steam-driven engines are all provided with automatic governors, which are very simple and cause practically no trouble. Electric governors, on the other hand, are a constant annoyance. If the engines are arranged conveniently to the boilers, they can be very easily looked after, and transmission losses are minimized. It is highly desirable for ad-

FIG. 5. LINCOLN SCHOOL, TOLEDO, O.

ministrative reasons and on account of noise, to keep all mechanical apparatus as far as is practicable outside of the school building.

STEAM.

The steam at 30 lbs. pressure, from the boilers, passes to the various engines, and from them goes, via oil separators, to the low-pressure piping. It also reaches the humidifier, heating the water, if a washer is used, or being injected directly to the warmed air on its way to the building. There is a connection from the boiler-pressure mains directly to the low-pressure mains via an automatic pressure reducing valve, which, in any failure of the exhaust steam to maintain a predetermined pressure, say, 1 lb., will introduce live steam as required. Steam, if dry, at any pressure has a natural temperature corresponding to that pressure. That part of the steam delivered through the reducing valve will be at the lower pressure but at the temperature corresponding to the original pressure—in other words, it will be super-heated, this superheat tending to re-evaporate any free moisture in the exhaust steam.

VACUUM.

Each unit of radiation and each terminal of the steam mains has a connection into the return piping through a trap. The virtue of this appliance is that it will pass water and air, but will not pass steam. On the end of the return main at the boiler-house is a pump, steam-driven and automatically arranged to maintain on the pump side of the traps a constant pressure less than that on the steam piping. Thus all air valves are eliminated; the radiators heat all over very quickly; and the most distant unit is hot nearly as soon as the nearest unit. Cold water contains a considerable amount of air, which is liberated when the water is changed to steam, and we have constantly to remove this air from the system. The pump, therefore, delivers the air back to the open, and sends the hot water to the boiler-feed pump which returns it, still very hot, to the boilers. The circuit thus is closed, and little outside water need be introduced, saving in fuel and in deposition of impurities as scale.

AIR-WAYS.

The entering fresh air, from the cleanest available source, preferably high up in a vertical wall so as to void surface or roof dust accumulations, is warmed by indirect radiation to a temperature above freezing; is then washed, and moistened; and then warmed to about 70° F. The air washer is composed of a circulating pump, sprays, a series of eliminators, and a tank which collects all surplus water, and which supplies the pump. The dust in the air adheres to the droplets of water, or is slapped out of the air by the abrupt changes in direction, against the wet eliminator plates, is finally washed into the tank, and screened out of the water. The humidity of the air is controlled by varying the temperatures of the air and the water where they come in contact with each other. It is necessary, therefore, if satisfactory results are to be gained, to have tempering heaters on both sides of the washer, and in addition to provide a heater for the circulating water. If no washer is installed, the air is warmed to about 70°, then moistened by steam jets. It passes to the fans, which force it to the main distributing ducts. These are purposely very large, prefefably of masonry, and are easy of access. They form in reality a long pressure chamber carrying the 70° air at slow velocity but considerable pressure—enough to balance, say, ¾ in. of water against atmospheric pressure at the most distant end. They have room for service pipes; are provided with lights, means for washing out, and are large enough for the attendant to walk through. They reach the base of every supply flue in the building. Anyone who has seen these large, clean, air

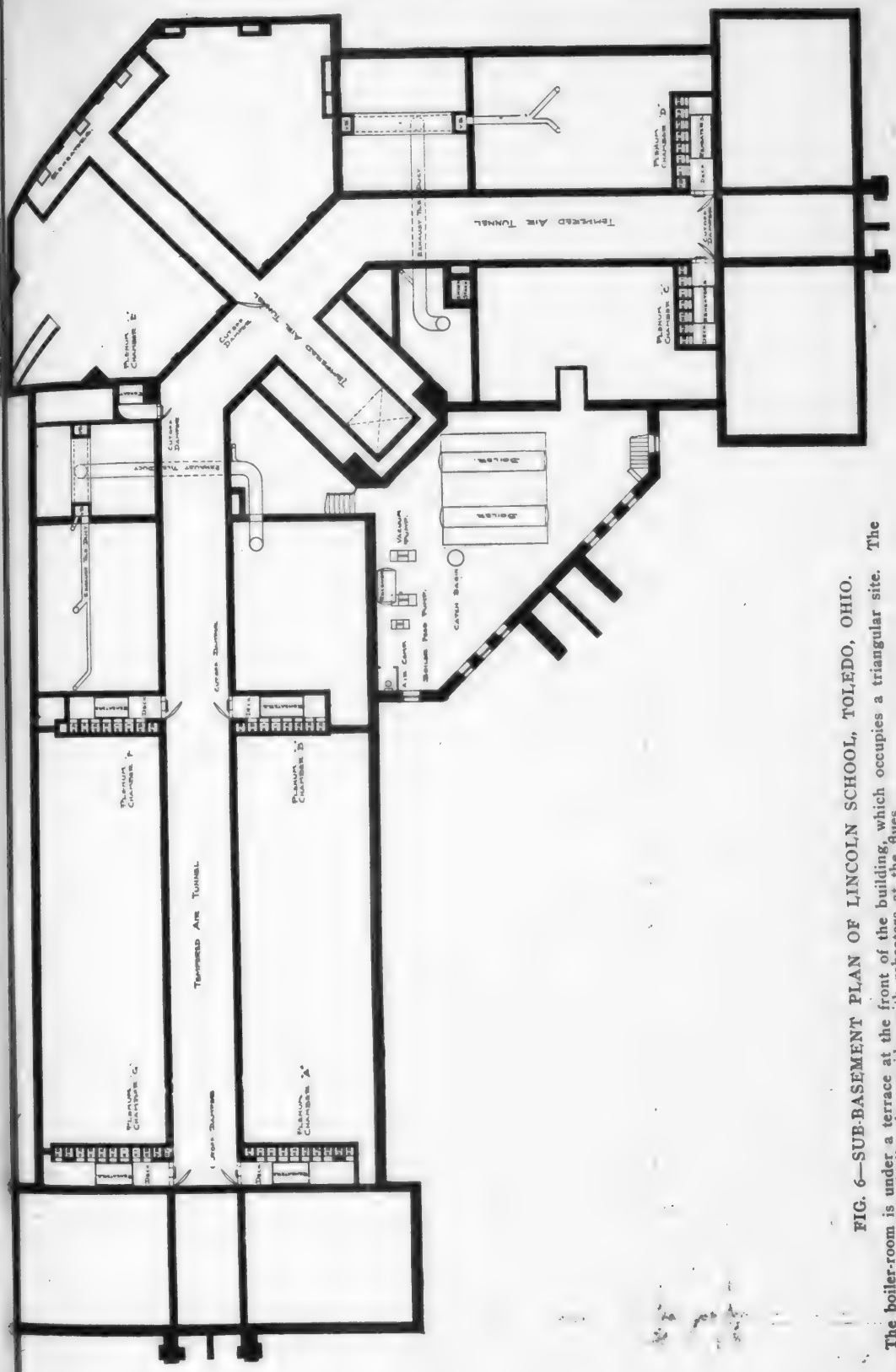

FIG. 6—SUB-BASEMENT PLAN OF LINCOLN SCHOOL, TOLEDO, OHIO.

The boiler-room is under a terrace at the front of the building, which occupies a triangular site. The tempered air tunnel underlies the corridor with reheaters at the flues.

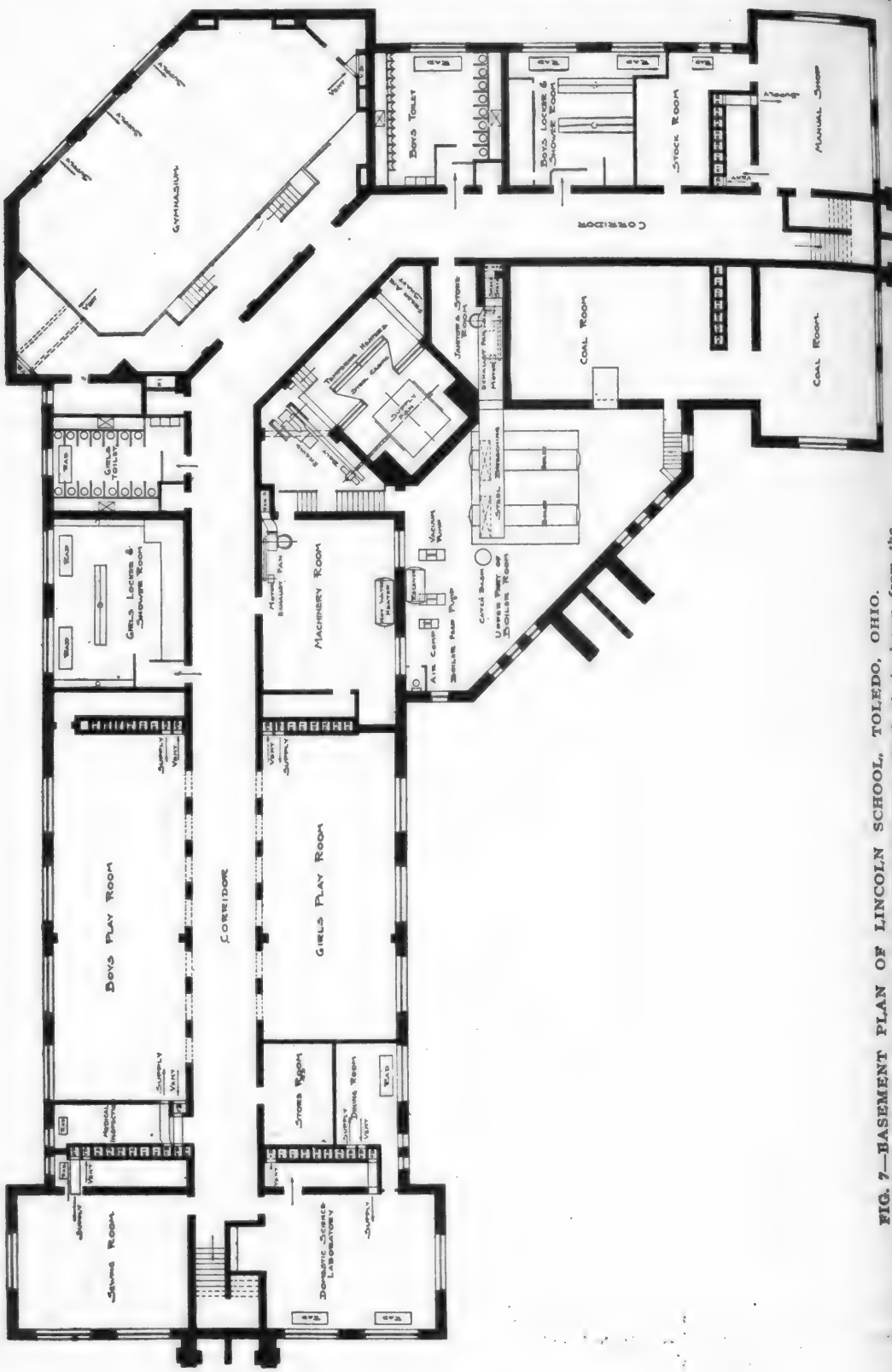

FIG. 7—BASEMENT PLAN OF LINCOLN SCHOOL, TOLEDO, OHIO.

The fan and its engine in this building are under the front entrance, which is drawn from the ... Fresh air is drawn ... and ... is provided.

The fan and its engine in this building are under the front entrance. Fresh air is drawn from the

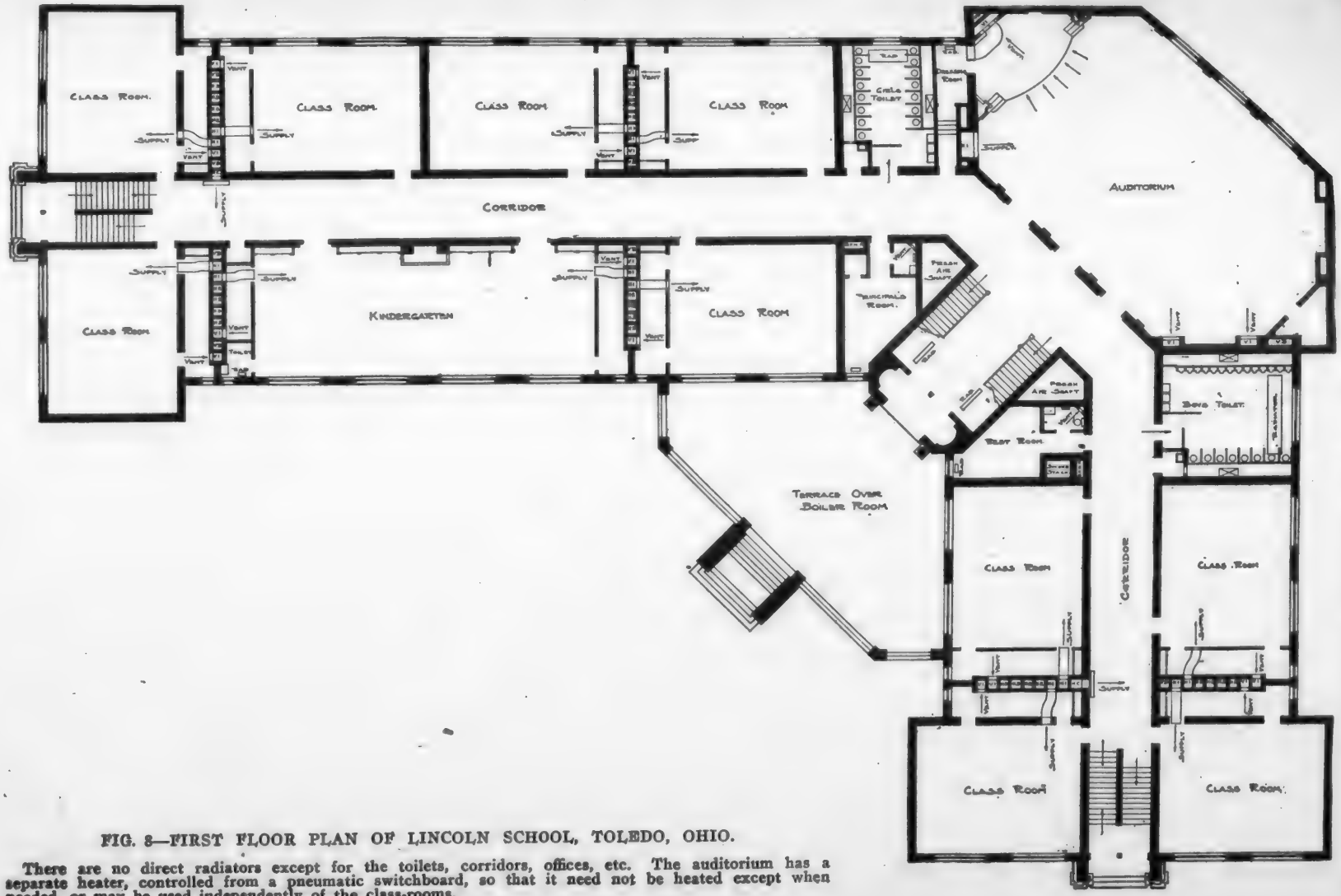

FIG. 8—FIRST FLOOR PLAN OF LINCOLN SCHOOL, TOLEDO, OHIO.

There are no direct radiators except for the toilets, corridors, offices, etc. The auditorium has a separate heater, controlled from a pneumatic switchboard, so that it need not be heated except when needed, or may be used independently of the class-rooms.

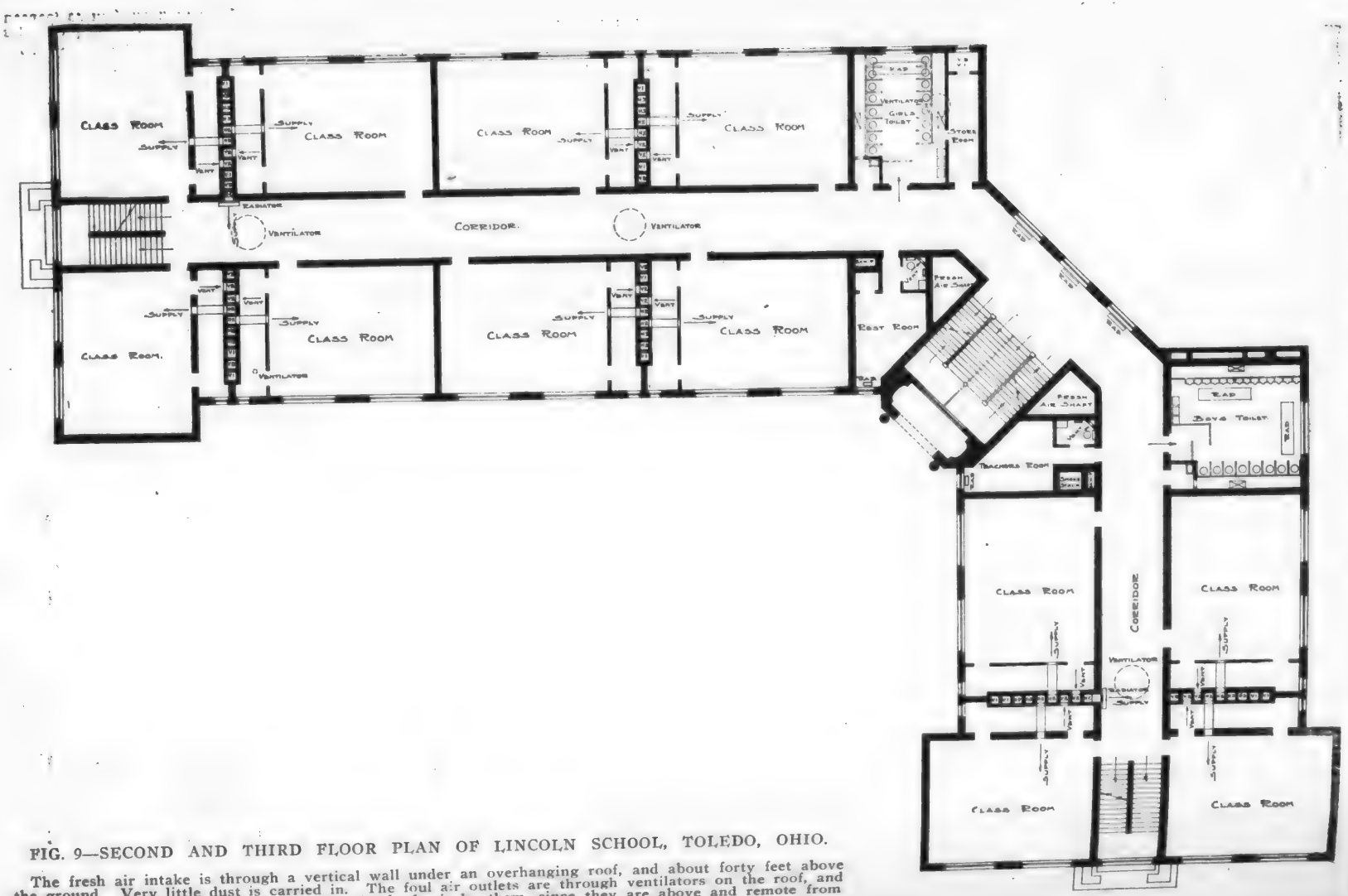

FIG. 9—SECOND AND THIRD FLOOR PLAN OF LINCOLN SCHOOL, TOLEDO, OHIO.

The fresh air intake is through a vertical wall under an overhanging roof, and about forty feet above the ground. Very little dust is carried in. The foul air outlets are through ventilators on the roof, and there is no possibility of contamination of the fresh air by them, since they are above and remote from the inlet.

ducts and who has compared them with the uncleanable and inaccessible metal ducts usually provided, will testify as to their superiority.

HEATERS.

From the comparatively slow speed and high static pressure of the air-ways, the fresh air passes into the flues through mixing dampers operated by thermostats automatically, and through volume dampers, hand-adjusted, both

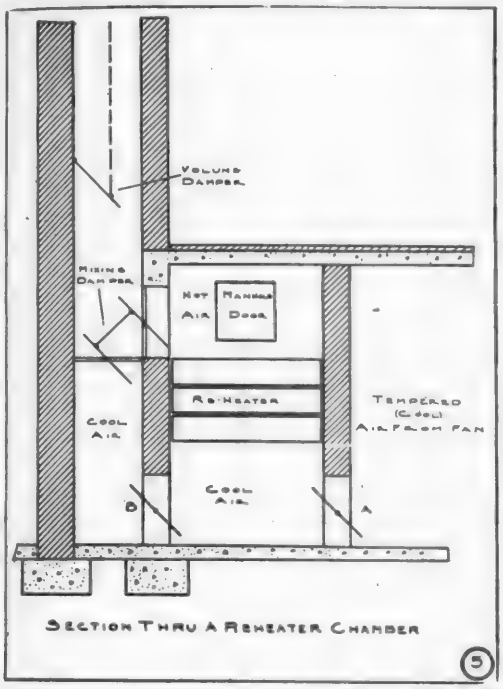

FIG. 10. This reheater supplies seven rooms, through seven flues, only one of which is shown in the cut. Damper "A" is controlled by a pneumatic switch in the engine room, and may be closed when for any reason the seven rooms are not to be heated. Damper "B" is for cumulative heating and is, with similar dampers in the cool air entrances to all other flues, operated by a pneumatic switch in the engine room. The mixing dampers admit a constant volume but varying temperature of air to the flue, controlled by the thermostat in the room served by the flue. The volume damper is hand-controlled and when once adjusted is never moved.

located at the flue bases. When the rooms are cooler than the point at which the thermostats are set, the air is not permitted to pass the cool air part of the mixing damper, but rises to the hot air part of the mixing damper (Fig. 10), through steam radiation of sufficient capacity to furnish the heat lost via glass and walls. The heated air rises directly into the rooms, and is not conveyed horizontally any appreciable distance after it has been heated. If several flues happen to be adjacent, the heaters may well be combined so that after any one of the rooms has become warm and has its warm air mixing damper closed, the heating surface provided but now not required for that room, instantly and automatically serves all the rooms in that group, which are still cool.

The resistance to air travel interposed by these heaters, mixing dampers and volume dampers, is relied upon to enable us to maintain a high static pressure in the main air-way. As soon as the air leaves the air-way and enters the flue above the dampers, it is under very much less pressure and its velocity decreases. This arrangement is designed to permit the free opening of windows in any rooms without affecting other rooms, for if the pressure in a room is increased by open windows it means that in all probability plenty of fresh air is entering the room and little, if any, air will enter through the regularly appointed supply flue. Yet there is no danger of this pressure backing down the flue, through heaters and dampers, and having any particularly objectionable effect on any other rooms against the high-way pressure. If, on the other hand, the room is on the lee side, and the pressure in it on opening the windows becomes less than normal, then the flue hastens to furnish fresh air due to the drop in resistance pressure, but this increase is of no particular effect on the other rooms, since the main air-way static pressure tends to be maintained in any event by the throttling resistance at the heaters and dampers.

AIR DELIVERY.

Since the air is not heated above 70° F., until it arrives where it is wanted, with a fair steam delivery system, the most distant room is heated as readily as the nearest room. Until the room is warm, of course, the entering air will

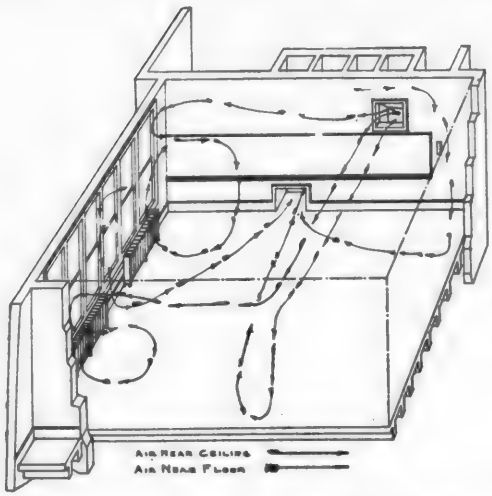

FIG. 11 The air currents are affected by temperature, falling near the glass, rising near the radiators, neutral in some spots, rapid in others. When the entering air is warmer than that in the room, the fresh air stays at the ceiling; when cooler, it falls to the floor at once.

be at a temperature which, depending on the movement of the mixing dampers, may reach 110°. This, however, is of no more serious effect on the vital quality of the air than if we had direct radiators in the rooms, for with the slower air passage of the much greater hot surface of the direct raditors, the air the radiation at the flue bases, having the air sprayed through it at high speed, wiping the heat constantly away, we can do do with 33⅓% of the radiating surface which would be necessary for any room in direct radiators placed in the rooms. The air, warmed and conditioned as necessary, then, is delivered into the rooms. If it is permitted to be introduced more than around 10° cooler than the air in the rooms, no matter where or how it is entered, it causes discomfort. The usual method of introducing the air near the ceiling at low speed as shown in Fig. 11, and toward the glass is proven under ordinary conditions, to be very inefficient. There is marked lack of air movement at many points in the room, and unduly high movement at others. The dilution is very uneven. It is quite clear, in fact, that the dilution of the old air with the fresh air is not an easily maintained process, and that to achieve ventilation we should abandon any schemes which depend on dilution for their success. We can probably achieve fair ventilation by dilution only while we operate numerous local fans in the rooms which accomplish the dilution mechanically, after the manner of an egg-beater. We have observed, however, that in any heated room the warmer air will be at the ceiling and the cooler air at the floor.

BEST METHOD OF INTRODUCING AIR.

The simplest and easiest adaptation of the usual building construction, we believe, is to introduce the fresh air at the highest speed commensurate with considerations of comfort and sound, at a tagent to the largest circle which can be inscribed in the room, at a vertical point over the heads of the occupants, with the outlet at the floor. The location of the outlet in plan, with reference to the inlet in plan, seems to be of small importance, but the outlet, we believe, is best placed in an interior partition near the cool walls, as illustrated in Fig. 12. With his arrangement a corkscrewlike movement of the air, and a general whirling effect of the entire room air content, is achieved,

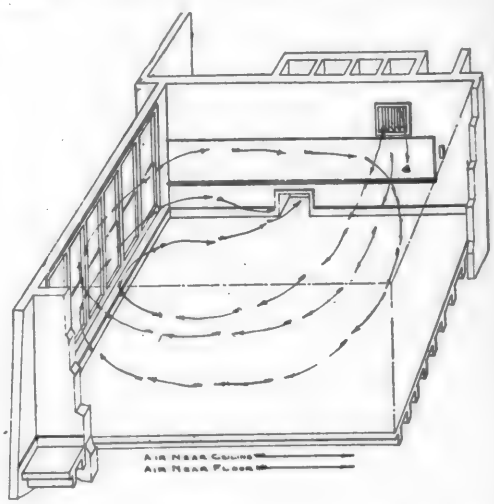

FIG. 12. The tendency of the cool walls and glass to cause the air to approach the floor is used, in connection with the horizontal current due to fan pressure, to achieve a corkscrew or spiral circuit from inlet to outlet.

wiping away the aerial envelope from the bodies of the occupants and giving the desirable summer breeze simulation. Ventilating flues should never be placed in outside walls, unless they are very perfectly insulated. The increase in weight due to cooling the escaping air,

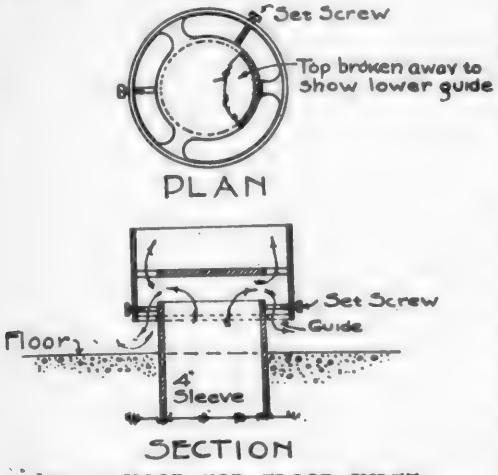

FIG. 13—HOOD FOR FLOOR INLET.

and the leakage in from outside, tend to render outside wall vent flues of very small value.

The foregoing applies to class-rooms having up to fifty pupils each. For other rooms which have special requirements or furniture, more efficient arrangements are made. For auditoriums, for instance, no air handling scheme yet devised equals the upward system, from an air chamber under the floor, with hooded openings under each seat (Fig. 13), the air movement being upward over the bodies of the occupants and directly to ceiling outlets. By no other ventilating device of which we are cognizant, is it possible to prevent an unduly high temperature in the galleries of a lofty room, and in our opinion with upward heating and ventilation it is unnecessary to compensate by increasing the temperature of the entering air for the heat lost through the ceiling and upper parts of the side walls. It is, however, especially necessary to provide for condensation on the upper walls and glass, since the temperatures are so much lower at these points than with any other type of heating system. Skill is required in designing upward systems, to obtain even air distribution, and the inlet velocities must be low, probably not exceeding 150 linear feet per minute. Care must also be exercised in operating such rooms to prevent any sudden variations in the temperature of the entering air due to the intimate contact with the occupants.

VENTILATION FOR GYMNASIUM AND SIMILAR ROOMS.

For gymnasiums and similar rooms, the air will be introduced through the window sills (Fig. 14). The openings may be narrow, and as long as the windows are wide. The air is delivered vertically, and tends to give the same distribution efficiency in the rooms as would be obtained if the windows were opened. Radiators in gymnasiums are most objectionable, because of the obstruction they offer and because of danger of burning persons; but the advantage of radiators may be gained by furring around them with tile or metal,

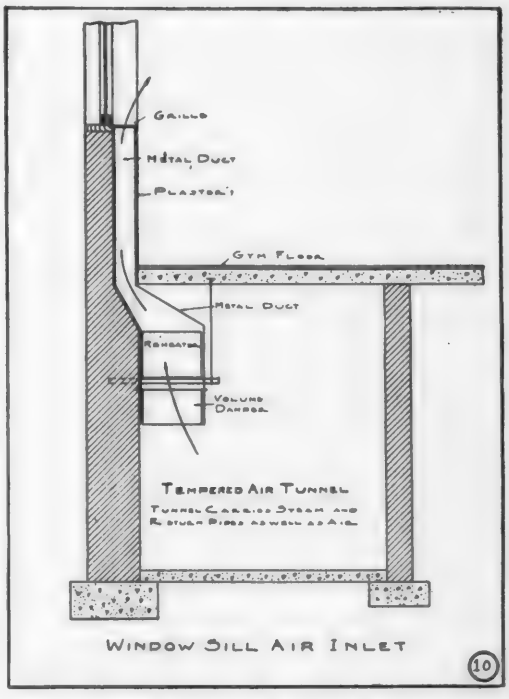

FIG. 14—WINDOW SILL AIR INLET.

and blowing the air supply up through them, with long, narrow inlet registers above the radiators, in the window sills or elsewhere. About one-third of the

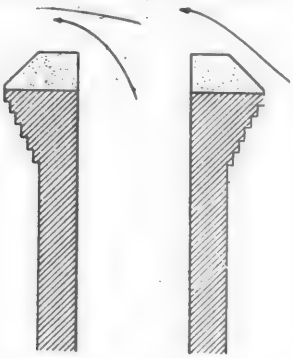

FIG. 15—APPROVED CHIMNEY TOP.

radiating surface will be required where so arranged, as would be required for common direct radiators. It is highly desirable that lofty rooms often without attic spaces under their roofs, have air outlets at the ceilings as well as at the floors, particularly for use in warm weather, or when using the ventilating system as a cooling apparatus.

air. Such apparatus positively will prevent odors being transmitted outside of the rooms in which they originate.

EXHAUST VENTILATION FOR CHEMICAL LABORATORIES.

The exhaust arrangements for chemical laboratories must take into consid-

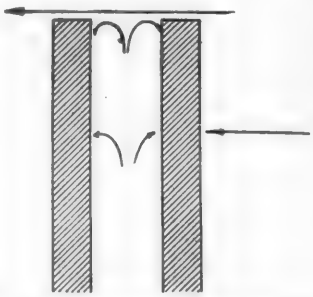

FIG. 17—IMPROPER CHIMNEY TOP.

eration the products which are heavier than air, and in general all chemical vent outlets should have both up-draft and down-draft facilities. The usual overhead hoods are generally ineffective unless an excessive volume of air is handled.

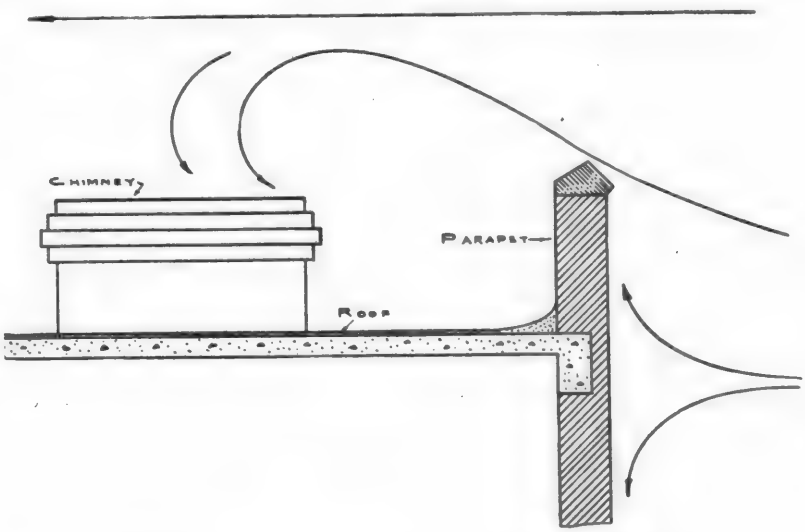

FIG. 16—WIND EFFECT ON A LOW CHIMNEY.

For domestic science rooms and the like, the ordinary ventilating plant will be supplemented by local electric-driven, exhaust fans, operated by the instructors with push-buttons when necessary for eliminating odors or high temperature

OUTLETS FROM BUILDINGS.

The separate exhaust fans each have an independent outlet through the roof, arranged so as not to contaminate the fresh air supply. This is generally

possible of accomplishment when outlet and inlet must be anywhere near each other by extending the outlet chimneys higher than the fresh-air intakes. Since a heated building is like a hot-air balloon, and the warm air asks nothing better than to be permitted to escape, there seems no especial need of exhaust fans except for removing odors or aiding in cooling some unusual room. The

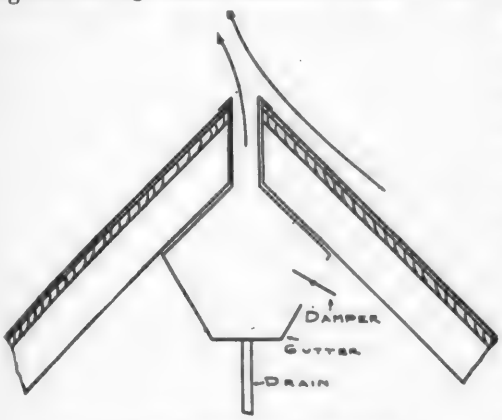

FIG. 18—AIR OUTLET IN RIDGE.

type of roof outlet, however, has a very marked effect on the operation of the plant. Tests have established that an open chimney with a bell around its top which tends to deflect any horizontal wind currents upward, is more effective than anything else, and that the usual ventilator hoods are measured in efficiency by how much rain and snow they keep out while interfering least with the air passage (Figs. 15, 16 and 17). In general, circular ventilator hoods are better than narrow rectangular ones. Always the outlets, unless of the pivoted type, must be open all of the way around. A ventilator not open all around becomes a funnel when the opening is to windward, and no fan pressure used in ventilating plants can compensate for wind pressure down such a funnel. No side wall vent outlet from a building, therefore, can be depended upon. Long, narrow outlets in the ridge of sloping roofs are very effective, and may be open on top, with gutters in the attic to catch the rain and snow (Fig. 18). We have no instances of such outlets causing any trouble, when properly designed. The escape of heated air when the building is not occupied is prevented by dampers pneumatically operated from the engine room.

ROOF CONSTRUCTION.

The skylights, where possible, will be guarded from condensation trouble by having the dry, warm air from the building pass under them on its way out. If this is not possible, there must be provided proper steam coils to keep the air which comes in contact with the skylights above the dew point temperature.

SPECIAL STEAM MAINS.

The offices, toilets and rooms having plumbing fixtures are heated by radiators which are supplied with steam from a separate main to that used for supplying the balance of the building, so that these rooms may be kept warm economically at times when the ventilating plant is closed down.

THE HEATING AND VENTILATING MAGAZINE

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IN PRESENTING this "Fuel Conservation Number" to the trade we feel that it is not only a fitting wind-up to the part taken by THE HEATING AND VENTILATING MAGAZINE in the Trade Extension Campaign, but that its contents, including the suggestive announcements of our advertisers, may easily prove of far-reaching value in the impending fuel stringency. One more step, however, is needed to make the effort a complete success and that is the unbiased and energetic co-operation of our readers. Heating engineers are often considered biased in their devotion to favorite methods and appliances and while this may often be a good fault it is likely to leave one behind in these days of stupendous world movements and developments.

Engineers and contractors always owe it to themselves, no less than to the trade they represent, to acquaint themselves with the latest developments in fuel-saving apparatus and appliances, but just now, when the coal situation is about to again become a national problem, they are confronted with a very grave responsibility, as well as an opportunity, of doing much more than their share in saving that extra shovelful.

From a commercial standpoint, the trade may well congratulate itself on the turn of events that has placed the science of heating at the very forefront of activities connected with the war. There has been some question as to whether general building work could be called an essential industry, but when it comes to the remodeling of existing buildings and the installation of fuel-saving equipment, this work already has the right of way and will go far towards keeping the industry on its feet during the war period.

THE QUESTION has often been asked, why are heating engineers provincial in clinging to their own views and methods? One answer is that they are not. But to a large extent it is true that there is less open-mindedness than there should be. It used to be said that the cause was the comparatively narrow field and the fact that heating is not an exact science. The field itself, as everyone knows, has been expanded to such an extent as to give it a definite place as one of the major industries. Progressive men in the trade are fully awake to this fact and are keen to hear of all the new appliances and to assure themselves of their merits. Most of our readers, we are confident, are included in this class and they will never have a better opportunity than right now to assume a position of leadership in their profession.

Latest Advices on Next Winter's Coal Situation

In order to obtain the latest rulings of the United States Fuel Administration on the outlook for the supply of anthracite coal for house-heating purposes during the coming winter, THE HEATING AND VENTILATING MAGAZINE addressed a letter to the Fuel Administration asking for a statement on the subject. In reply, dated August 14, 1918, A. S. Learoyd, director of the anthracite distribution for the Fuel Administration, makes the following statement:

"The Fuel Administration has not made any ruling or order as to the proportion of coal to be allotted to householders during the coming winter. I think I can best get the whole matter before you by sending you a copy of the order of the United States Fuel Administrator covering the local distribution of coal this year.

"With particular reference to anthracite, it is felt that the allotments made in New England, New York State, Pennsylvania and New Jersey, Maryland, Delaware and the District of Columbia are sufficient to cover 100% of the minimum needs of the domestic consumer.

"Anthracite has been eliminated this year entirely south of the Ohio and Potomac Rivers, excepting in Virginia where the allotment was approximately 40% of the actual tonnage of 1916 and it has also been eliminated in the States West of the Mississippi, excepting the upper portion of Iowa, Minnesota, North and South Dakota.

"The tonnage to the central states like Illinois, Indiana, Ohio and Michigan has been materially reduced from the tonnage shipped in 1916.

"Eliminations and reduction were necessary in order to provide for the minimum needs of the notheastern section of this country, where only anthracite coal is available for domestic consumption."

Details of Coal-Distribution Order

The order referred to by Mr. Learoyd is known as Publication No. 19 and is entitled, "Regulations of the United States Fuel Administration Regarding the Retail Distribution of Coal and Coke for the year 1918." The full text of the order follows:

The United States Fuel Administration recommends and encourages the purchase and storage of coal and coke for necessary domestic requirements as early as possible in order, first, to insure the delivery of coal and coke for this purpose, and, second, to assist the transportation companies by effecting delivery of as much coal and coke as possible before next winter.

The following general plan has been adopted governing retail distribution for 1918. Conditions differ so widely in different localities that no attempt is made to provide for every contingency and the State Fuel Administrator is authorized to make certain modifications as indicated in the regulations hereinafter set forth when necessary to meet local conditions:

I. Every consumer should be urged on or before April 1, 1918, to place with his regular dealer his order for his reasonable normal requirements for the year ending March 31, 1919. Such orders must be made in writing and must state substantially the information called for in regulation (*c*) hereinafter set forth. When such orders have been entered, the dealers shall proceed to make deliveries thereon, until each consumer, willing to accept the same, has received two-thirds of his normal annual requirements, provided that orders of 6 tons or under may be filled in full. When all consumers, who are willing to accept it, have received two-thirds of their normal annual requirements, the dealers may proceed to fill the balance of such orders up to normal annual requirements of each consumer. (*The provision for two-thirds delivery should apply only to anthracite. With respect to bituminous for domestic use, the dealer may proceed to deliver the consumer's normal annual requirements.*) If a consumer already has a quantity on hand, he shall receive only such additional amount as shall make up his normal annual requirements.

New consumers who are unable to have their orders accepted by a dealer should apply to

the local fuel administrator, who should see that their requirements receive attention from the proper dealer. Carload or bargeload lots shall not be delivered to a single domestic consumer or to a group of consumers except with the permission of the local fuel administrator. Dealers shall file with the local fuel administrator on the first of each month a statement containing the names and addresses of consumers to whom deliveries have been made during the previous month and the quantity delivered to each.

II. The following regulations have been established by the United States Fuel Administration:

(*a*) Until further notice no domestic consumer of coal or coke shall purchase, receive, or otherwise take possession of, more coal or coke than is required for his actual and necessary requirements prior to March 31, 1919. If such consumer already has a quantity on hand he shall receive only such additional amount as shall make up his actual and necessary requirements prior to that date.

(*b*) No person, firm, association, or corporation, whether acting alone or in conjunction with others, shall, directly or indirectly, provide any domestic consumer of coal or coke with more coal or coke before March 31, 1919, than is necessary, with the amount already on hand, to meet the actual and necessary requirements of such consumer prior to that date.

(*c*) On and after April 1, 1918, no person, firm, association, or corporation shall sell or deliver coal to a domestic consumer who does not first furnish to the person selling or delivering such coal a statement which the consumer declares in writing to be true, and which specifies (1) the amount of coal the consumer has on hand, (2) the amount of coal he has on order and the name of the person from whom ordered, (3) the amount of coal used by him in the 12 months ending March 31, 1918, and (4) the amount of coal needed to meet his actual and necessary requirements prior to March 31, 1919; provided, however, that this regulation may be modified by any State Fuel Administrator within his own State under such circumstances and conditions as he may deem proper.

(*d*) On and after April 1, 1918, and until further notice, no retail dealer shall, unless authorized by the State Fuel Administrator, deliver or cause to be delivered to any domestic consumer more than two-thirds of his normal annual requirements of anthracite coal until each domestic consumer who has placed his order with said dealer and is willing to receive delivery of the same has received two-thirds of his normal annual requirements for the year ending March 31, 1919; provided, however, that orders of 6 tons or less may be filled in full.

(*e*) Carload or bargeload lots shall not be delivered to a single domestic consumer or to a group of consumers, except with the permission of the local fuel administrator.

(*f*) Dealers shall file with the local fuel administrator, on the first of each month, a statement containing the names and addresses of consumers to whom deliveries have been made during the previous month and the quantity delivered to each.

Any dealer or consumer who violates the foregoing regulation will be subject to the penalties prescribed by the Lever act.

Such further regulations will be issued as may be necessary to enforce the essential features of the foregoing plan.

The purpose of the plan is to secure the broadest and most equitable distribution possible during the coming year. The Fuel Administration is assured by the representatives of the National Retail Coal Merchants' Association that the retail dealers throughout the country will lend their hearty co-operation in the performance of this patriotic service.

Accompanying the order is a form, reproduced herewith, which consumers are required to fill out before receiving their coal allotments:

APPLICATION OF CONSUMER FOR ANNUAL REQUIREMENTS.

In accordance with regulations of the United States Fuel Administrator, purchasers, are required to make true declaration in answer to the following questions:

Name of dealer.....
City ..... Date.....
Quantity required for year ending March 31, 1919 .....
Quantity required for immediate delivery.....
Quantity consumed during year ending March 31, 1918 .....
Quantity now on hand.....
Kind of building .....
Number of rooms.....
Kind of heating plant.....
Have you any unfilled orders with other dealers? If so, amount and with whom.....

I hereby certify that the above statements are true to the best of my knowledge and belief.

Name .....
Address .....

Any person who wilfully makes a false statement upon the foregoing application is subject to prosecution under the Lever Act, which imposes a penalty of $5,000 fine or two years' imprisonment, or both.

Publications of the United States Fuel Administration.

For the convenience of our readers a list is given herewith of all of the documents issued by the United States Fuel Administration to date. The law creating the administration is listed as "Public No. 41—65th Congress—(H. R. 4961)," being "an act to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of food products and fuel":

Publication.	*Date Issued.*	*Subject.*
No. 1.	Aug. 23, 1917.	H. A. Garfield Appointed Fuel Administrator.
No. 2.	Aug. 21, 1917.	Prices of Bituminous Coal Fixed by President Wilson.
No. 2-A.	Oct. 29, 1917.	Amendment to Order of August 21, 1917, relative to Prices of Bituminous Coal.
No. 3.	Aug. 23, 1917.	Anthracite Coal Prices and Jobbers' Margins Fixed by President Wilson.
No. 4.	Jan. 1, 1918.	Summary of Coal Prices in Effect January 1, 1918.
No. 4-B.	Feb. 1, 1918.	Further Classification of Bituminous Coal (Tennessee, Alabama, Virginia and North Dakota).
No. 4-C.	March 1, 1918.	Further Classification of Bituminous Coal (Maryland, West Virginia, Virginia, Alabama, Illnois and Pennsylvania).
No. 4-D.	April 22, 1918.	Coal Prices at the Mine in Effect April 22, 1918.
No. 5.	Sept. 6, 1917.	Task of the Fuel Administration (Statement of H. A. Garfield).
No. 6.	Sept. 7, 1917.	Apportionment of Coal Supply and Regulation of Retail Coal Prices.
No. 7.	Oct. 1, 1917.	Maximum Gross Margins of Retail Coal Dealers.
No. 8.	Oct. 1, 1917.	Shipment, Distribution and Apportionment of Coal Reshipped by Water at Lake Erie Ports.
No. 9.	Oct. 4, 1917.	Rulings of the Fuel Administrator (First Series).
No. 10.	Oct. 9, 1917.	Fuel Supplies for Railroads.
No. 11.	Oct. 26, 1917.	Order Relative to Prices for Coal Received by Water at Docks on Lake Michigan and Lake Superior.
No. 12.	Nov. 9, 1917.	Order Regulating Use of Coal Generating Electricity Used in Operating Illuminated Signs.
No. 12-A.	Dec. 14, 1917.	Amendment to Order of November 9, 1917, Relating to the Use of Fuel in Operating Illuminated Signs, Etc.
No. 13.	Nov. 9, 17, 24, 1917.	Orders Relative to Prices of Coke.
No. 14.	Jan. 14, 1918.	Regulation Relative to the Sale, Shipment, Distribution and Apportionment of Coal and Coke and the Price Thereof in Case of Diversion.
No. 15 (revised).	Dec. 13, 1917. Feb. 25, 1918.	Order Relative to Prices for Coal for Foreign Bunkering Purposes and Export Cargoes; also Amendments of February 25, 1918.
No. 16.	Dec. 24, 1917.	Order Regulating the Making of Contracts by Operators, Producers, and Jobbers of Coal and Coke.
No. 17.	Jan. 17, 1918.	Regulation Providing for a More Adequate Supply of Fuel for Railroads, Domestic Consumers, Public Utility, and Other Uses Necessary to the National Security.
No. 17-A.	March 4, 1918.	Order Modifying Certain Provisions of the Regulation of January 17, 1918, Providing for a More Adequate Supply of Fuel.
No. 18.	Feb. 4, 1918.	Regulation Governing Licensees Engaged in the Business of Distributing Fuel Oil.
No. 18-A.	March 19, 1918.	Revised Rules and Regulations Issued by the United States Fuel Administrator Governing Licensees Engaged in the Business of Distributing Fuel Oil.
No. 19.	March 9, 1918.	Regulations of the United States Fuel Administrator Regarding the Retail Distribution of Coal and Coke for the Year 1918.
No. 20.	March 20, 1918.	Regulations Concerning Cleaning and Special Preparation of Bituminous Coal.
No. 21.	March 22, 1918.	Zone System for the Distribution of Bituminous Coal.
No. 22.	March 22, 1918.	Proclamation by the President of the United States and Rules and Regulations Relative to Licenses for the Distribution of Coal and Coke.
No. 23.	April 1, 1918.	America's Coal Problem in 1918.
No. 24.	April 10, 1918.	Maximum Prices of Coke, with Modification Showing Dates when Effective (Corrected to April 1, 1918).
No. 25.	June 1, 1918.	Regulations Concerning Inspection of Coal at Mines, Methods of Preparation, and Definition of Grades.
No. 26.	May 25, 1918.	Order Reducing Prices of Bituminous Coal in all Producing Districts Ten Cents per Ton.
No. 27.	June 5, 1918.	Order Establishing Regulations and Prices for the Handling and Sale of Bituminous Coal Received by Rail and Water at Docks Located on the Great Lakes.

All the above-listed publications are on file at the office of THE HEATING AND VENTILATING MAGAZINE. Copies may be obtained by addressing the Superintendent of Documents, Government Printing Office, Washington, D. C.

An additional publication issued by the Fuel Administration, under date of August 1, 1918, without number, is entitled "Fuel Facts," and is a compilation of information on the coal situation, with suggestions for operating various types of heaters. Some of these are given herewith:

GENERAL RULES IN MANAGEMENT.

1. Be sure there is a check draft-damper in the smoke pipe, besides the turn damper. This check draft damper is as important in controlling the rate at which the fire burns

as is the throttle of an engine. Open it to check the fire. Close it to make the fire burn more rapidly. Experiment with it in the daily regulation of your fire. Make it do its work. The coaling door was not put on the heater to check the draft. If you cannot check the fire without opening the coaling door, you need proper dampers.

2. The turn-damper should fit the smoke-pipe loosely and must never be entirely closed. With the average plant it may be kept partly closed most of the time in mild weather, but during severe weather it usually needs to be opened wide.

3. Make use of the lift or slide-damper in the coaling-door *only to let oxygen in to consume gases,* if you are using soft or bituminous coal after fresh fuel has been added.

4. Just enough draft and that from below, checking the draft by *letting more air into the smoke-pipe,* is one of the best general rules. This furnishes oxygen from below, necessary for the consumption of the coal-gases, and at the same time gives time for them to be consumed before being drawn up the chimney. This method also avoids escape of coal-gas into the cellar. To make the fire burn more rapidly, do not open the whole ash-pit door, but only the draft-damper in the ash-pit door. Opening the whole ash-pit supplies air to the fire faster than it is needed for combustion. The air is heated, passes out the chimney and is so much heat wasted.

5. All heat pipes in the cellar should be thoroughly and completely wrapped with asbestos or similar covering to prevent loss of radiation.

6. Grates should be cared for properly. A short, quick stroke of the shaker handle will sift the ashes through the grates. Leave grates in flat position when through shaking. Clean ash-pit daily, to prevent damage to grates. In severe weather grates should be shaken until a glow appears in ash-pit. In moderate weather a bed of ashes should be carried on top of the grates.

7. Avoid poking and slicing fire-bed. It causes draft holes and clinkers.

8. Never shake a fire that is low until you have put on a little fresh coal and given it time to ignite. A thin fire wastes coal. Disturb the fire as little as possible.

9. Storm-doors and storm-windows, weather-strips and such protective devices are economical of heat.

10. Keep the temperature of sitting-rooms at sixty-eight degrees or less. If there are invalids, old folk or very little children in the family, the temperature may be higher. Rooms where you do not sit are more comfortable if much cooler, as a rule, providing the air is kept a little moist. Get a thermometer—a good one. Use it inside, not hanging outdoors.

11. It is wasteful to allow the temperature to drop way down at night. It takes twice as much coal to heat it up again next morning.

12. Turn off the heat in unused rooms whenever possible. Bed-rooms should be kept much cooler than living rooms. Don't try to heat all the rooms all the time. If you have a hot-water system, make heavy radiator slip-covers and put them over radiators when not in use. This will prevent freezing.

13. Always keep two pans or open-top jars of fresh water on radiators or in front of registers to keep the air in the home moist.

14. Study the Specific Rules applying to the system of heating in your house.

STEAM HEATERS—SPECIFIC RULES.

1. The water in the boiler should be completely changed at least as often as every spring and every autumn. Draw a bucketful of dirty water from the bottom at least twice a week and each time replenish with fresh water from the supply-pipe. Cleanliness of water in the boiler is of prime importance.

2. Look at the glass water-gauge whenever you attend to the fire. Turn the exhaust-cocks above and below the gauge occasionally to make sure that it is not clogged or the openings to it from the boiler closed up. They must be kept open.

3. The level of the top of the water must always show at some point along the gauge. Its height will vary with the temperature of the water; but if it rises above the top of the glass there is too much water in the boiler and some must be drawn off; and if it sinks below the bottom of the glass some more water must be let into the boiler.

4. Be sure that the exhaust-valve of each radiator works. Sometimes these valves need cleaning with a pin or soaking in kerosene. If in doubt about one of them unscrew it from the radiator when the fire is low and there is no steam-pressure, or else after turning off the radiator. If you can blow through it, it is all right. If not it must be cleaned until you can. Don't fail to replace it. It is advisable to have an extra valve to replace any one that is temporarily out of order.

5. Don't fail to study the General Rules, applicable to all heating-plants, and also to keep the boiler-flues clean.

HOT-WATER PLANTS—SPECIFIC RULES.

1. All the water should be emptied from

the plant and clean water put in at least as often as every spring and every autumn.

2. When the first fire of the season is built, as the water gets heated, take the radiator key and open up the exhaust-valve of each radiator in turn until all the air remaining in each radiator is allowed to escape. Repeat this operation occasionally to make sure there is no air interfering with free circulation of the water.

3. Always be sure that water shows in the glass gauge of the exhaust tank, which is usually located in the top story of the house above the level of all radiators.

4. Be sure the boiler is covered with asbestos, as well as the pipes in the cellar.

5. Study carefully the General Rules relating to all types of plants. Keep heating surfaces of the boiler well cleaned.

Supply of Coal Limited to Cement Manufacturers.

One of the first industries to fall under the ban of the United States Fuel Administrator as non-essential and, therefore, one in which the use of coal should be restricted, is the cement industry, including manufacturers of Portland cement, natural cement and Puzzuelan (slag) cement. Such manufacturers, in a special order dated August 8, 1918, are restricted to an amount of fuel, including coal, coke, natural gas, fuel oil, or other petroleum products, or to use power derived from any such fuel, sufficient to permit them to manufacture 75% of their annual production of cement from January 1, 1915 to December 31, 1917. Provision is made for the burning of additional fuel on certain conditions, after receiving the permission of the United States Fuel Administration. Wood and peat, when not requiring railroad transportation, may be used for the manufacture of cement.

The Country's Coal Requirements.

According to the estimates of the United States Fuel Administration 735,000,000 net tons of coal will be required to meet the demands of the country for the current coal year, ending March 31 next. With the progress of the war and the growing demand for coal this figure may be revised upward.

One hundred million tons of the requirements must come from the anthracite fields, leaving 635,000,000 net tons of requirements from the bituminous mines. The total bituminous production last year was 554,000,000 net tons, which makes necessary an increased production of 81,000,000 tons. The Fuel Administration does not anticipate that the bituminous coal production will go far beyond 600,000,000 net tons. The difference must be made up of savings.

The coal budget made up by the Fuel Administration shows that the requirements for industrial uses will be 242,024,000 tons, which is an increase of 18% over the estimated consumption for last year.

For domestic uses 75,678,000 tons of soft coal has been allotted.

The gas and electric utilities have been apportioned 37,941,000 tons this year, as against 33,038,000 tons consumed last year, an increase of 15%.

The railroads require this year 166,000,000 tons as against 155,000,000 tons last year, the increase amounting to 7%.

The mines themselves will use 12,500,000 net tons this year, whereas 11,000,000 tons sufficed last year. The increase amounts to 14%.

Two million additional tons will be required to take the place of oil, principally in the West.

Plans of the United States Fuel Administration for Inspecting Steam Power Plants.

As has already been announced in these columns, the United States Fuel Administration is about to conduct an investigation of all the steam-power plants in the country with a view, first, of securing their more efficient operation in order to reduce the total coal consumption, and, second, of curtailing the allottment of coal to those plants which fail to comply with the recommendations of the fuel administration.

At the time of writing (August 22) the work of inspection is in its initial stages, being confined largely to the preparation and sending out of the fuel administration's questionnaire and recommendations. Both of these circulars are reproduced herewith. We are indebted to *Power* for the arrangement of the circulars for reproduction. A few inspectors have been sent out but from this time on the work is expected to proceed rapidly.

Special attention is called to the fact that a power plant will automatically fall into the lowest class of rating until the questionnaire is duly executed and returned. Following the first report authorized inspectors will call at the plants and efforts at fuel conservation will be noted and will be a means for securing a higher rating for such plants.

American Public Health Association will hold its annual meeting in Chicago, October 14-17, 1918.

Standard Questionnaire Covering

Issued by Bureau of Conservation

THIS FORM FOR GENERAL INFORMATION—NOT TO BE USED FOR RATING OF PLANT.

Date of Report.....

Name of company, concern or owner.....

Address of Central Office.....

Name and location of plant inspected.....

Character of product or service.....

Stationary Boilers

WATER-TUBE BOILERS

Number	Hp	Kind of Draft			How Fired		Total Hp.	Remarks
		Nat'l	Forced	Induced	Stoker	Hand		

FIRE-TUBE BOILERS

Number	Hp	Kind of Draft			How Fired		Total Hp.	Remarks
		Nat'l	Forced	Induced	Stoker	Hand		

Movable Boilers*

Number	Hp	Type	Remarks

* In the rating of the plant movable boilers will be considered separately The questionnaire does not call for information regarding movable boilers except as per above table. The influence of movable boilers on the rating of the plant will be left to the judgment of the Administrative Engineer.

Kind of coal..... Bituminous Semibituminous Anthracite

Size .....

Tons of coal of 2000 lb. used during twelve months ending May 1, 1918.....

Months of operation of plant during the same year.....

Approximately what percentage of live steam is used for:

	Winter Per Cent.	Summer Per Cent.
(a) Making power		
(b) Heating building		
(c) Process work		

Is purchased electric power used? .....

If so, how many kilowatt-hours consumed during twelve months ending May 1, 1918? .....

Records

Are records kept to show any of the following information? Answer "Yes" or "No" in table.

	By Shift	Daily	Weekly	Monthly
Water evaporated by boilers				
Coal consumed by boilers				
Flue gas analysis				
Electrical output or consumption kw.-hr				

Engine Equipment

STEAM UNITS—ENGINES, TURBINES, PUMPS

Type	No	Initial Pressure	Rating				Type of Valve Gear
			Hp.	Kw. or Gal. Per Min	Condensing	Noncondensing	
Simple							
Compound							
Turbine							
Steam Pumps							

What changes have you in progress which are expected to reduce your fuel consumption?

.....

When will they be in effect?

.....

Further remarks by owner:

.....

Note to Owner: If sufficient space is not available in the questionnaire, please attach an extra sheet with the additional information.

Recommendations by the Fuel Administration

That provision be made for weighing and recording of the fuel used each shift or day.

That feed water be heated and measured.

That provision be made for an adequate supply of air to the fuel and convenient means provided for the measurement and control of the draft.

That provision be made to keep boiler surfaces clean inside and out.

That the grates be in good repair, that settings, breeching and access doors be free from air leakage, and that boiler surfaces wasting heat be covered with insulation.

That the surfaces of steam piping, drums and feedwater heaters which waste heat or steam by radiation be properly covered with insulating material.

That exhaust steam be utilized wherever possible, to the exclusion of direct steam from the boilers. The plant should be so designed that no more exhaust steam will be produced than can be efficiently utilized in heating or process work.

That a competent man in the plant be detailed for the work of fuel conservation in the boiler and engine rooms.

That a competent man or committee be detailed for the work of fuel conservation in the building or shop outside of the power plant.

the Operation of Steam Power Plants

United States Fuel Administration.

THIS GROUP OF QUESTIONS TO F ORM BASIS OF RATING OF PLANT.

(a) FUEL: Value of question, 9. Mark rec'd.....

Question 1. What provision is made for weighing fuel used each shift or day?

Question 2. What records are made of fuel used each shift or day?

Question 3. What grate surface is in use each shift, exclusive of banked fires?

Question 4. Total coal used each shift exclusive of banked fires?

(b) WATER: Value of question, 15. Mark rec'd . . .

Question 1. What provision is made for heating and continuous measuring of feed water (check answer in table below)?

Heating	Means Used for Measuring
Open feed-water heater	
Closed feed-water heater	
Exhaust steam	
Direct steam	
Waste heat economizer	

(c) AIR SUPPLY: Value of question, 12. Mark received .....

Question 1. Are means provided for measuring the draft over the fire?

Question 2. Are means provided for determining the excess air by flue-gas analysis?

Question 3. Are dampers provided for equalizing the draft in the furnaces?

Question 4. Is there a convenient means for regulating the draft by main or uptake damper?

Question 5. Is there an automatic damper regulator in working order?

(d) CLEAN HEATING SURFACES: Value of question, 12. Mark received .....

Question 1. What provision is made for keeping soot and ashes from boiler-heating surfaces (mark answer in table below)?

Steam lance for blowing soot by hand	
Mechanical soot blower	
Brushes or scrapers	

Question 2. How often are the soot and ash cleaned from the boiler-heating surface?

Question 3. What provision is made for keeping scale and sediment out of the boiler (check answer in table below)?

Chemical treatment of feed water in the boiler	
Chemical treatment of feed water outside of boiler	
Filtration of feed water in open feed-water heater	
Filtration by means of feed-water pressure filter	
Other means	
Water is free from scale or sediment without treatment	

Question 4. What means are used for removing scale from the boiler?

Hand..... Mechanical.....

(e) BOILER AND FURNACE SETTING: Value of question, 20. Mark received.....

Question 1. Are the grates warped, broken or otherwise defective?

Question 2. Check air leaks observed, as follows:

Leaks in boiler setting			
Openings between boiler and setting			
Badly warped fire-doors			
Badly warped cleaning or access doors			
Leaks around blowoff piping			

(f) INSULATION: Value of question, 7. Mark received .....

Check any of the following items where saving could be made by covering surfaces with insulation:

Exposed drums of boilers	
Exposed shells of boilers	
Steam piping in boiler room	
Steam piping in engine room	
Feed-water heater	
Exhaust-steam piping where fuel could be conserved by covering	
Feed lines	

(g) ENGINE-ROOM AND HEATING SYSTEMS: Value of question, 15. Mark received.....

Question 1. Is exhaust steam used: Entirely..... partly.....not used?.....

Question 2. State service for which this steam is employed: Heating.....Cooking..... Dry room.....Tank heating.....Low-pressure turbines..... Other purposes .....

Question 3. Is there an excess of exhaust over requirements?

	Day	Night
Winter		
Summer		

Question 4. Is there any low-pressure live steam used in the plant?.....At what pressure? ....lb. gage. For what purpose?..... Heating..... Cooking.....Dry room ..... Tank heating..... Other purposes.....

(h) SUPERVISION: Value of question, 10. Mark received .....

Question 1. Has the owner detailed a competent employee to supervise the work of fuel conservation in the boiler and engine plants with directions to report weekly on measures for economy and progress in conservation of fuel?
Name and title of this employee

.....

.....

.....

Question 2. Has the owner appointed a man in charge of the work of fuel conservation outside of the boiler and engine rooms described under Recommendations?
Name and title of this employee

.....

.....

.....

How Leaking Steam Ran into Money in a Hotel Plant

Remarkable Savings Effected at the Cleveland Hotel Statler Through Changes in the Heating System.

Saving $11,000 on the steam bill of a modern hotel during one season's operation will be admitted to be a remarkable achievement, yet this is what has been accomplished at the Cleveland Hotel Statler, following certain changes in the equipment of the plant.

It should be stated that for some time the consumption of low-pressure steam for heating the Hotel Statler in Cleveland was considered by the management to be excessive. An investigation was undertaken about a year and a half ago by J. G. Morgan, supervising engineer for the Hotels Statler Company, and a report was submitted to Mr. Statler with recommendations that certain alterations be made in the heating system to effect an estimated saving of approximately $6,000.

The recommendations were approved by Mr. Statler and the alterations completed as planned at a cost of $8500. They consisted principally of installing new valves on the return ends of the radiators in place of those in use.

We are indebted to Mr. Morgan for the following, taken from his official report:

The accompanying consumption record (Table 1) gives an idea of the savings effected by the alterations, although it should be borne in mind that a concerted effort was put forth toward the conservation of steam. One point, however, is certain. Prior to the installation of the new equipment, it was found impossibe to maintain a vacuum on the heating system without the use of a ¾-in. jet water introduced into the water end of the vacuum pumps to condense the steam that leaked through the old valves. This past season no jet water was used and the vacuum has been maintained without difficulty.

In Table 1 the consumption record is given in pounds condensation, the measurements being taken at the meters after the steam had passed through the radiators and returned to the receiving tanks by the vacuum pumps. Owing to the difference of mean temperatures for the various months, a credit should be allowed for a theoretical increased consumption in 1917-1918, when the mean temperatures were lower than in 1916-1917, and a debit when the temperatures were higher.

Subtracting Column 5 from Column 1, we show an actual saving, states the report, of 7,504,109 lbs. low-pressure steam in the first six months of the heating season 1917-1918, as compared with the same period of the 1916-1917 season. To this add 5,471,000 lbs. rebated to the hotel by the Cleveland Electric Illuminating Company on account of a leak in a steam coil in a hot-water generator, giving a total of 12,975,109 lbs. less steam used during this period, which at 35 cents per 1000 lbs. amounts to $4,541.28.

Add 401,109 cu. ft. city water at 40 cents per 1000 cu. ft. (used as jet water in 1916-1917), amounting to $160.44.

Add also cost of 75 tons of coal at $5.00 per ton (charged to Cleveland Electric Illuminating Company), equalling $375.00. Adding the foregoing three items gives a total actual saving of $5,076.72.

This, however, does not tell the whole story. Column 9 of Table I shows the net average percentage credit due, amounting to 12½%. Figures compiled by users of the Cleveland Electric Illuminating Company's low-pressure steam (taken from invoices of 1916-1917 and 1917-1918 seasons) operating under the same conditions, show an increase of approximately 20%. Figured on this basis the increased consumption credit for 1917-1918 was 10,624,287 lbs., which at 35 cents per 1000 lbs., amounts to $3,718.50.

On account of leakage in the bathroom radiators, approximately 500 of them were replaced. With this and the steam lines to the other radiators cleaned out, there have been added approximately 2800 sq. ft. of direct radiation in those rooms. Based on a consumption of 4 sq. ft. to 1 lb. condensation per hour, ten hours per day, 30 days per month, seven months per heating season, we have an additional estimated steam consumption of 1,764,000 lbs. over 1916-1917. Figuring this amount of steam at 35 cents per 1000 lbs. gives a total of $617.40 to be credited to 1917-1918 operation.

During March, 1918, the rate on low-pressure steam was increased by the Cleveland Electric Illuminating Company from 35 cents per 1000 lbs. to a sliding scale which will average about 68 cents per 1000 lbs. This rate will continue in force unless changed by decision of the court. There is now an injunction suit in progress. This increase, for the month of March, 1918, would add a credit of 4,671,922 lbs. which at

1 Month	2 Pounds	3 Mean Temp. Deg. F.	4 Month	5 Pounds	6 Mean temp. Deg. F.	7 Diff. in mean temp.	8 Percentage of credit or debit based on 1916-1917 consumption	9 Pounds Credited or debited compared with 1916-1917 consumption	10 1917-1918 Computed consumption if operated on 1916-1917 basis, pounds
1916			1917						
October	9,154,343	52.7	October	9,469,112	46.5	—6.2	+.40	3,661,737	12,816,080
November	9,786,349	42.3	November	11,225,297	38.2	—4.1	+.23	2,250,860	12,037,209
December	11,774,264	29.0	December	13,611,430	22.4	—6.6	+.21	2,472,795	14,247,059
1917			1918						
January	16,133,752	27.3	January	15,583,769	15.0	—12.3	+.29	4,678,780	20,812,532
February	14,356,038	21.3	February	9,951,153	28.2	+ 6.9	—.15	2,153,405	12,202,633
March	14,683,020	37.3	March	8,542,896	40.2	+ 2.9	—.10	1,468,302	13,214,718
	75,887,766			68,383,657					85,330,231

35 cents per 1000 lbs., amounts to $1,541.73.

The house count for the six-month period has been slightly under 3% less than for the same period of last season. For this we should deduct 3% of 75,887,766 lbs., or $843.07.

Finally, there is the estimated saving on steam consumption for the balance of the year. If the increased rate continues in force, this will amount to 2,170,743 @ 33 cents = $716.34.

RECAPITULATION.

Actual saving 1917-1918 over 1916-1917	$5,076.72
Percentage credit on account of lower mean temperatures	3,718.50
Added radiation,	617.40
Increase on account of higher rate	1,541.73
	$10,954.35
Deduct on account of lower house count	843.07
Total saving for first six months of heating season	$10,111.26
Estimated saving on steam consumption balance of fiscal year, 2,170,743 lbs. @ 35 cents per 1000 lbs.	759.75
Additional saving if increased rate continues in force	716.34
Total estimated saving for the year	$11,587.39

Since rendering the foregoing report the engineering department has kept a record of the steam consumption for the additional months to August 1, 1918. The comparative figures are as follows:

	1917		1918	
		Mean temp.		Mean temp.
	Pounds	Deg. F.	Pounds	Deg. F.
April	9,199,216	45	8,867,431	46
May	8,182,886	51	3,763,439	64
June	3,987,525	65	2,122,000	67
July	2,280,000	..	1,265,000	..

The steam for guest-room heating was turned off during the last month of May. The consumption for June and July was for hot water heating. The saving of approximately 1,000,000 lbs. was accomplished by alterations that stopped leaks, as well as by reducing the consumption of hot water in the hotel laundry.

National Safety Council will hold its seventh annual congress in St. Louis, Mo., September 16-20, 1918. Headquarters will be at the Hotel Statler. Special sessions will be given over to health work in the industries.

Leaky Windows an Unnecessary Handicap to the Heating Industry

By Alfred M. Lane.

Today building construction might be considered almost a science. Practically every single item that enters into the construction of buildings, of any class, has its valuation determined to a high degree of accuracy. We know the bending moments of steel, the breaking strains of cast-iron, the tensil strength of cement, the weathering value of paint, the rust-resisting qualities of galvanized iron, and various other materials too numerous to mention. The architect must necessarily know absolutely the character of the materials he proposes to use in the construction of the building in his charge, and he designs it with the perfect confidence, as a result of experience, tests, etc., that with these materials a building will stand as a monument to his knowledge of what is safe and practical.

The heating engineer completes the building, insomuch as he makes it habitable. He, in turn, determines with the same degree of accuracy the size of radiators, risers, returns, mains, boiler and valves, with the necessary fuel consumption to properly heat the building. His calculations, however, cannot be 100% accurate, because he must guess at the amount of radiation to offset the in-leakage of cold air on the windward side, and the out-leakage on the leeward side around the windows and doors of the building.

This leakage can never be determined absolutely because the human equation enters into the construction and fitting of sash and doors. A mechanic will not fit two windows in the same room with exactly the same amount of cracks between the sash and the frame. The character and age of the wood is a large factor. One side of the frame will shrink more than another. Time and expense does not permit guarding against every detail that would affect the fitting and hanging the sash.

For instance, it is good practice, in the brick specifications, to call for brick to be shoved and grouted, which necessarily follows that this slushed mortar must fill in around each frame. The wood in the frame absorbs a large percentage of the mortar. The initial set of the cement is approximately two hours; therefore, the frame has only one way to swell, and that is inward, or away from the brick at the center. This is the reason you will find the center of the frame narrower than at the sill or head, also the sill buckled up, making the height in the center shorter than at the sides. It is necessary to fit a sash so that it can be raised and lowered past the narrowest part of the frame, to wit: where the meeting rails come toegther when the window is closed. As a result, there is a crack on each side of the sash at the head and sill that is much larger than the crack at the meeting rail.

SIZE OF AVERAGE WINDOW CRACK

It is a well-known fact, proven by twenty years' experience in the building business, that the average crack around a window is approximately one-eighth of an inch. A 3 ft. x 7 ft. window, which is common, will have 20 ft, of cracks around the sides, top and bottom, and 3 ft. at the meeting rail, making all together 23 ft. of cracks one-eighth of an inch wide, equivalent to 34½ sq. in. of an opening that permits cold air to enter on one side and warm air escape on the other side of the building. This handicap on the heating apparatus must be overcome by excess radiation and an oversize boiler.

If there was a hole left in the glass of each window six inches square, the owner and architect would refuse to accept the building from the contractor. It would be obvious to every one that these holes would have to be closed up to make the building fit for occupancy. The principal reason for the rejection of these windows with the holes in them would be on account of their being seen, but, on the other hand, if the same area was divided into small holes scattered over the wall area of a room, nothing would be said if they were not noticeable, and accepted on the theory that "what you don't know won't hurt you." This is the same theory on which thousands of architects, heating engineers and owners accept a building with the same size hole, except it is in the form of a crack around the windows.

The writer has always considered a heating specification very similar to a purchase contract of lightning rods; there is a joker in it. Heating specifications invariably state a building shall be heated to a temperature of 70° F. inside when the thermometer is zero outside, but nothing is ever said at what wind velocity, and yet heating engineers agree that it is much harder to heat a building to 70° inside

when the thermometer is 30° outside, with a wind velocity of twenty miles an hour, which is common in the winter, than it is to heat a building to the same temperature with the thermometer zero outside, and *no* wind. Therefore, as stated above, the heating engineer must necessarily take into his calculations a "guess."

The only absolute way to control the leakage around the windows is by properly weather stripping them, and they should be a part of the heating engineer's specifications just as much as the character of the valve, wall thickness of pipes, kind of covering and size of flue to the boiler. He provides for expansion in his pipe lines, and water in a hot-water system, and should make the same provision for expansion and contraction between the sash and the frame. Specifications should read: "These plans and specifications for heating apparatus are designed to heat a building at a temperature of 70° inside with the thermometer zero outside, in any wind velocity, providing all windows and doors are weather-stripped with an equipment that shows not more than one-half cubic foot air leakage for every lineal foot of cracks around a window; weather strips shall be adjustable to swelling, shrinking and warping of the sash, under all conditions, guaranteed by the manufacturer against defective workmanship and material for a period of five years."

It is the writer's opinion that nine-tenths of the heating Engineer's trouble is due to leaky windows. He is held responsible for an over-consumption of coal, too much or too little heat, and is helpless to overcome it because he is not responsible for the general construction of the building. A well-known heating engineer once said: "It is an easy matter to heat a well-constructed building, but it is possible to design a plant that will heat a bird-cage." A building resembles a bird-cage insofar as the cracks around the windows are concerned. It is by far more important to control the air leakage around the windows with metal weather strips than it is to control the supply of steam or water to the radiators with valves. Weather strips will contribute more to the economic operation of a heating plant, the health and comfort of the occupants, than any other single device entering into the construction of a building. Besides weather strips are the only items in the building that are not a source of expense of upkeep and repairs. If it is necessary to prevent leaks in any part of the heating systems that conveys heat to a desired location, why is it not just as necessary to prevent leaks around windows and doors that convey cold air to those same locations? Boilers and pipes are covered to prevent heat losses by convection. Why not fill cracks around windows and doors to prevent heat losses by conduction?

The heating engineers, through their society should, in the writer's judgment, take immediate steps to conduct a scientific test of the efficiency of metal weather strips, classifying them according to the results, the same as other materials have been classified, and then lay out their plans and prepare their specifications according to the type of weather strip to be used, placing the ultimate responsibility where it belongs on the owner.

The Hitch in Heating Houses by Electricity.

In the application of electricity to heating buildings, this has a seasonal requirement, having the period of maximum demand usually short and having a long period in the summer when there is no demand. It can be supplied economically by electricity only where the generating stations are without other load in the winter time. This occurs very rarely, but there are a few cases, such as occur in irrigated regions in which water is pumped by electricity which in turn is generated from water-power. Here, it is necessary to keep a load on the plant to prevent freezing in the winter and this can best be accomplished by connecting a heating load to the lines. If a fuel-fired generating station were to be large enough to care for this maximum peak-load which would occur in the coldest winter weather and which would be superimposed on the usual power and lighting load, the investment for the plant and the distribution system would be very high and it is doubtful whether it would be possible to furnish the energy for heating as cheaply as the coal could be bought and burned. Continuity of domestic heating in cold weather is also a vital point. Failure of the power system would bring wholesale disaster to the community relying on it for heat. Not that there are no cases in which such heating can be done satisfactorily, for there are many special cases in which such electric heating of spaces in buildings may be commercially economical. In general, however, at the present time, with Nature's stores of fuel to draw upon, the general substitution of electricity for fuel for this purpose does not seem probable.—*Frank Thornton, Jr., before the Engineers' Society of Western Pennsylvania.*

Modern Practice In Vapor Heating

EDITOR'S NOTE.—*For the purpose of this series of articles, a vapor, vacuum, vapor-vacuum, vacuum-vapor, atmospheric, modulated or themograde system of heating will be considered as any system in which the steam pressure ordinarily carried is practically at atmosphere or slightly below or in which the returns are open to the atmosphere and where no pump or other positive mechanical device is employed to pull back the returns.*

III.—THE McALEAR SYSTEM.

The McAlear Mfg. Co., of Chicago, Ill., makes vacuum and vapor appliances for a variety of uses and has developed its own systems of vapor and atmospheric character. These are separated into two separate and distinct systems which are differentiated by this manufacturer as follows:

"A *vapor* system is one which generally operates within 2 lbs. of atmosphere and should be provided with some positive means to return condensation to the boiler at any pressure difference between the boiler and the returns."

"An *atmospheric* system is one which is operated at within a few ounces of atmosphere and depends for its successful performance on very sensitive damper regulation since any rise in boiler pressure will prevent the return of the condensation."

The distinction as above enumerated practically boils down to a vapor system being capable of carrying up to 2 lbs. gauge pressure (due to the automatic return trap being able to return the water to the boiler under this pressure) whereas the atmospheric system has no such return trap and therefore must operate at a lower pressure of only a few ounces.

The chief advantages mentioned for the vapor system include:

First.—A rapid and quick circulation of steam throughout all radiators with steam pressure not to exceed 3 oz. or 4 oz.

Second.—The automatic removal of air and

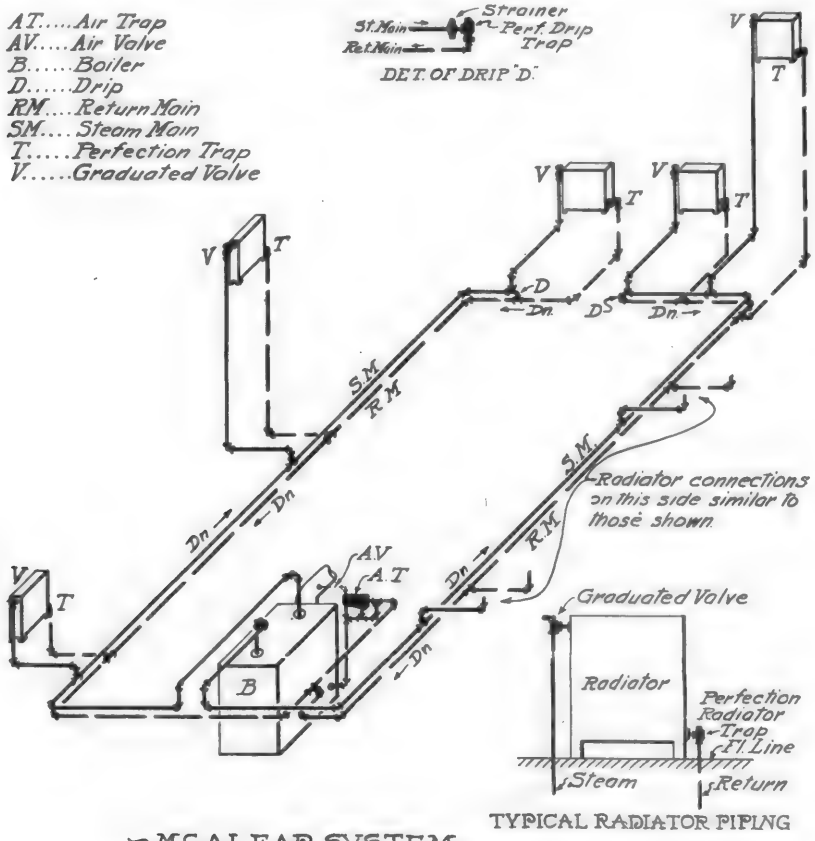


FIG. 1—TYPICAL LAYOUT OF McALEAR SYSTEM.

water from the radiators and piping system to the air exhauster and return trap located on the boilers, discharging the air to the atmosphere and the water of condensation into the boilers.

Third.—The economy in operation due to the Circulation of steam at low temperatures, making it possible to operate with the same degree of economy as a hot-water heating system, but with a much higher efficiency due to the rapid heating and cooling of the radiators, which is very advantageous in the Fall and Spring when only a little heat is required to take off the chill.

Fourth.—The pressures necessary for the circulation of steam on the system varies anywhere from a few ounces above the atmosphere up to any pressure necessary to get a circulation and heat. It is not necessary that the pressure be maintained at any particular fixed point with this system, but the greatest economy is had by circulating at 1 lb. or less.

Fifth.—The omission of air vents with the exhauster and return trap located on the boiler which exhauts all of the air from the system and discharges it to the atmosphere, and also receives the water of condensation and discharges it into the boiler.

Sixth.—The economy in operating over ordinary heating plants which depends largely on the pressure carried and the construction of the plant. If properly installed the saving in cost of operation will vary anywhere from 10% to 25%.

The requirements consist of special modulation valves on the radiator supplies, special traps on the radiator returns, a special return trap or special air valve at the boiler and (with the atmospheric system) a special super-sensitive damper regulator.

The *vapor* system with which this article particularly deals is illustrated in Fig. 1 and consists of a two-pipe system, the steam being carried from an ordinary steam boiler through a common and regularly-piped steam main up to the radiators into which it is fed through a graduated supply valve called by the manufacturer a "modulating" valve.

The steam and return main must be liberally sized so as to reduce the pressure drop to a minimum, while the return should be only one or two sizes smaller. The mains must be properly pitched and drained through traps to prevent steam blowing through into the return line. The return must run without pockets and be pitched in the direction of flow in order to permit freedom of air removal.

The modulating valves are of the packless type, their interior construction being shown in Fig. 2, and they are made in the sizes and carry the dimensions shown in Table I.

TABLE I.

	Inches.				
Size of Valve	½	¾	1	1¼	1½
Face of Outlet to Center Line of Inlet.....	1¼	1 5/16	1½	1¾	2
Face of Inlet to Center Line of Outlet.....	2½	2⅞	3¼	3½	3⅞

These valves are made in angle pattern only and employ varying discs to suit the different sizes of radiators, these discs being as shown in Table II.

TABLE II.

½-in. Valve					
Disc. No.....	1	2	3	4	5
Radiation, Sq. Ft.....	1–20	20–35	35–50	50–65	65–80
¾-in Valve					
Disc. No.....	6	7	8	9	10
Radiation, Sq. Ft.....	1–25	25–50	50–75	75–100	100–125
1-in. Valve					
Disc. No.....	11	12	13	14	15
Radiation, Sq. Ft.....	25–50	50–75	75–100	100–150	150–200
1¼-in. Valve					
Disc No.....	16	17	18	19	20
Radiaiton, Sq. Ft.....	75–100	100–125	125–150	150–175	175–200
1½-in. Valve					
Disc. No.....	21	22	23	24	25
Radiation, Sq. Ft.....	100–125	125–150	150–175	175–200	200–250

On the return end of each radiator is placed a "Perfection" radiator trap, a cross section of which is shown in Fig. 3. This trap is designed to close whenever a vaccum is created in the radiator and thus to prevent heating through the return connection; at the same time it is claimed that they permit the escape of air and water from the radiators in large quantities but close absolutely tight against steam, and when the radiator is shut down, prevent water and steam backing in through the return connection.

The chief advantages of these traps consist of having full ⅜-in. opening, being non-adjustable, self-cleaning, automatic, noiseless and fool-proof. By swinging on the union the outlet may be pointed down, or 45° for-

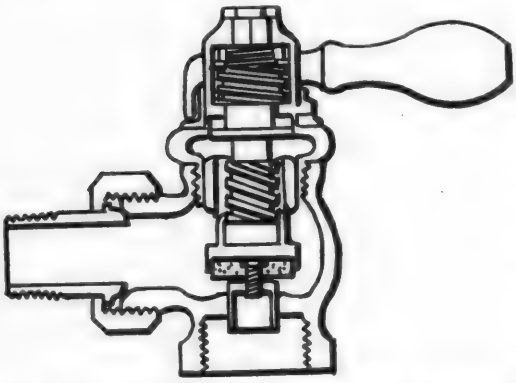


FIG 2—CONSTRUCTION OF McALEAR GRADUATED VALVE.

ward or back. This obviates the necessity of employing right and left hand valves; it is not impossible to turn the outlet horizontally if necessary but this is not recommended as the valve does not drain itself fully when set in this position.

These traps are known as No. 28, come in one size only, ½-in., and are good for anything up to 300 sq. ft. of direct cast-iron radiation. For blast coils and other large amounts of surface a larger trap is made, this being known as No. 34 and of ¾-in. size.

The dimensions are as shown in Table III.

TABLE III.

Dimension	No. 28 Inches	No. 34 Inches
Face to Center of Inlet..	2 1/16	2⅞
Face to Center of Outlet	2½	1⅞
Diameter of Valve Body	2⅜	3¾

For special cases valves with the diaphragms turned horizontally are provided.

After passing through the radiator trap the air and condensation follow down the return

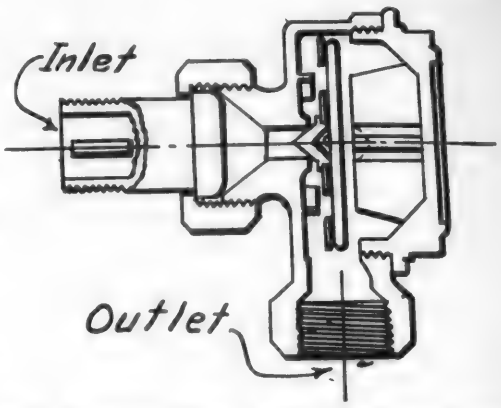


FIG. 3—PERFECTION RADIATOR TRAP USED WITH McALEAR SYSTEM.

line and back to the boiler. Near the boiler the return line has connected in parallel an "air exhauster and return trap"; a cross-section of this automatic return trap is shown in Fig. 4. It operates whenever the boiler pressure is sufficient to back the return up into its chamber. The principle of operation is the rising return which lifts the float and opens the steam inlet D. This equalizes the pressure on both sizes of the water so that the water falls into the boiler by gravity. After discharging, the air relief opens, relieves the steam pressure, the returns again flow into the trap and the process is repeated.

The *atmospheric* system follows throughout the same piping, valves and radiator connections described for the *vapor* system *except at the point where the returns enter the boiler.* Here no automatic return trap is provided but instead a Kieley air trap is substituted, this trap being constructed as shown in cross section in Fig 5 and with the piping arranged as shown in Fig. 6. These traps are built in eight sizes for vari-

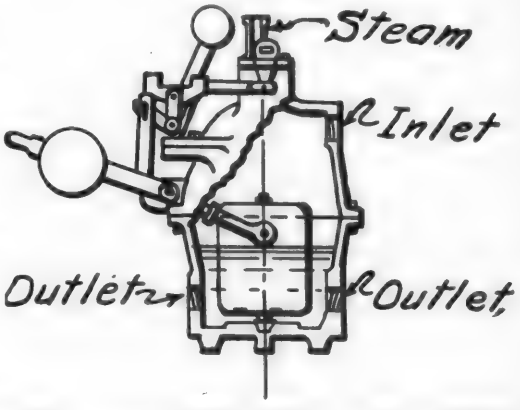


FIG. 4—AIR EXHAUSTER AND RETURN TRAP.

ous heating system capacities, as shown in Table IV.

TABLE IV

No. of Trap.	Sq. Ft. Radiation.
0	0 to 900
1	901 to 1300
2	1301 to 2000
3	2001 to 3300
4	3301 to 5000
5	5001 to 8300
6	8301 to 11500
7	11501 to 16500

As can be seen, this trap simply and solely

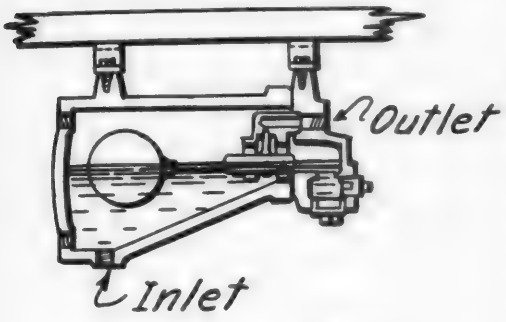


FIG 5—KIELEY AIR TRAP.

relieves the air from the system and does nothing to help return the condensation against the boiler pressure. Thus a very small increase in the boiler pressure is sufficient to flood the return and air bind the system if the return main is anywhere near the same level as the boiler water line. For this reason the vapor regulator illustrated in Fig. 7, is used to control the heating boiler, this being a very sensitive device which gives control of the boiler pressure by

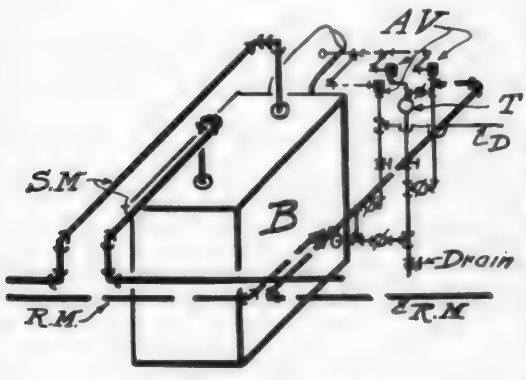


FIG. 6—ARRANGEMENT OF PIPING IN ATMOSPHERIC SYSTEM.

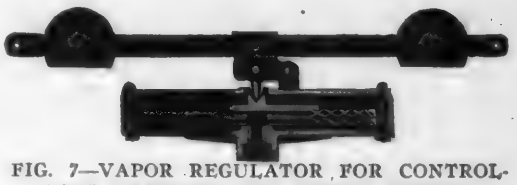


FIG. 7—VAPOR REGULATOR FOR CONTROLLING DAMPERS AND CHECK DRAFTS.

ounces and will operate at any pressure from 3 lbs. gauge down to 5 in. of vacuum.

LEGAL DECISIONS

Quantum Meruit for Labor and Materials.

In an action on quantum meruit for a balance due for materials and labor furnished in installing a heating plant in the defendant's building, the Missouri Supreme Court holds, Bradley Heating Co. *v.* Layman Realty, etc. Co., 201 S. W. 864, that where the owner of the building had breached the contract, the plaintiff was entitled to an instruction for the reasonable value of the materials and labor furnished, at least up to the contract price. Where there were no structural defects in the boilers funished by the contractor, and they were the identical boilers specified in the contract, it was not error to exclude evidence by the owner of that type of boiler. The plaintiff was not concluded by what he paid for the labor and materials furnished if he showed their reasonable value exceeded such sum.

Mechanic's Lien for Heating Plant.

The Minnesota Supreme Court holds, L. J. Mueller Furnace Co. *v.* Burkhart, 167 N. W. 286, that a complaint in an action to enforce a lien upon realty for a heating plant furnished for the improvement of a building thereon, including a copy of the lien statement, reciting that the plaintiff had a lien for a certain amount for a heating plant sold and delivered to a third party and used in the defendant's dwelling, signed and verified by the manager of its state branch, not technically showing the reasonable value of the material furnished, or whether the third party had paid the plaintiff therefor, or fully alleging any contractual relation between the plaintiff and such third party, was sufficient to give notice of the plaintiff's claim, and to entitle it to amend the complaint.

Contest for Possession of Tools and Equipment.

A contracting company, which became bankrupt, entered into a contract with a high school commission for the furnishing and installing of heating and ventilating apparatus for a high school building which was being erected or to be erected. The contract provided that if the work to be done under it should be abandoned by the company, or if the contract should be assigned or the work sublet other than as specified, or if at any time the architect should be of the opinion and should certify that performance of the contract was unnecessarily or unreasonably delayed, and that the company was violating any of the conditions or covenants, the commission should have the power to require the company to discontinue all work on three days' written notice, and that the commission might complete the contract in the manner provided by law, charging the company with the expenses, materials, labor, etc., which should be deducted from the contract price. The contracting company, which agreed to save a surety on its bond harmless, for that purpose executed an agreement reciting the assignment, transfer, and conveyance to the surety of all its title and interest in and to tools, equipment, and materials placed upon the site of the work, or which might be purchased for the work.

In a contest for possession of the tools and equipment the federal district court for the Northern District of New York holds, in re F. J. Sullivan Co., Inc., that the mere placing of the tools and equipment on the site of the building did not, on the theory that the contract with the commission was one of pledge, give the commission title to the property superior to the trustee in bankruptcy of the company, even though it is not necessary in every case that the pledgee himself take possession, for, as the company remained in possession until bankruptcy, and had complete control of all the property, it could not under any theory be deemed that the commission had possession.

How the Chicago Master Steam Fitters Came to Join the National Organization.

The addition of no fewer than 115 Chicago heating contracting firms to the membership of what is now the Heating and Piping Contractors' National Association was one of the most important events of the year in that organization. Some interesting details of the developments that led up to this action are told in the report of the association's board of directors, published in the association's *Official Bulletin* for August.

On October 25, 1917, states the report, President Almirall and Messrs. Grassler, Danforth and Bradley made a special trip to Chicago at the invitation of the Master Steam Fitters of Chicago to interest them in the national organization, and to extend to them individually and collectively an invitation to join the organization. The Chicago Association comprises about 115 men.

"We met with a most cordial reception at a noon luncheon," continues the report. "We were the guests of honor at a banquet in the evening, and if the 1917 convention had been held in Chicago, as planned, there is no doubt but that the Chicago organization would have become affiliated with us.

"But, with the entrance of the United States into war with Germany, conditions generally throughout the country were so upset that the directors at a meeting held in New York City on May 17, 1917, decided to postpone the regular annual convention, which otherwise would have been held in Chicago in June.

"As a result of postponing the 1917 convention no action was taken by the Chicago Master Steam Fitters' Association until April 23, 1918. On that date, at the request of the Chicago Association, Messrs. Oakes and Danforth, representing your board of directors visited Chicago and had the pleasure of attending a dinner at Hotel Sherman, which preceded the regular monthly business meeting. About 100 members were present. After dinner the Chicago association showed its patriotism by subscribing about $70,000.00 to the Third Liberty Loan, practically all of this being made up of additional subscriptions from individual members. This action was a wonderful demonstration of what men can do when they get together and associate with each other for a definite purpose.

"President Herlihy then introduced our Mr. Oakes to the meeting, and Mr. Oakes extended to the Chicago association an invitation to join our national association. He very clearly explained the purpose of our organization in a very interesting address. Your chairman (Mr. N. Loring Danforth of Buffalo) followed Mr. Oakes in an endeavor to set forth those things which our association has accomplished, and the reasons why the Chicago local association should become members of our national body.

"As a result of this visit to Chicago, and of previous efforts on the part of the gentlemen representing us, who attended the Chamber of Commerce Convention a few weeks before, in April, I am very glad to

announce that the Chicago Association decided that night to affiliate in a body with our national association. The action taken that night, which was informal, has since been ratified, and the Chicago Association of Master Steam and Hot Water Fitters, comprising about 115 members and constituting one of the strongest local associations in the country, are today fully qualified members of our national association."

NATIONAL DISTRICT HEATING ASSOCIATION

Meeting of Executive Committee Takes Place of Annual Convention.

While there was no convention of the National District Heating Association this year, the meeting of the executive committee and officers at Cedar Point, Ohio, July 8 and 9, was made the occasion for receiving the reports of the association's officers and standing committees for the year.

It was decided, among other things, that there should be constituted a new committee, to be known as the Committee on Standard Rules and Regulations, to co-operate with the Bureau of Standards and with public service commissions in preparing standard rules and regulations covering the heating business. This committee consists of H. R. Wetherell, Peoria, Ill., chairman, and J. L. Hecht, A. C. Rogers, D. S. Boyden, W. A. Wolls, J. H. Walker, E. L. Wilder, A. E. Duram, F. C. Ross, Thomas Donahue, J. D. Hoffman, N. M. Argabrite, J. C. Hobbs and Secretary D. L. Gaskill.

After receiving the reports of the standing committees the executive committee voted to refer all such reports, excepting that of the Public Policy Committee, to certain members for discussion before publication so that the discussion might be published with the reports.

Before the executive committee adjourned, a resolution was presented by the secretary, Mr. Gaskill, and unanimously passed; expressing the appreciation of the association for the services of S. Morgan Bushnell, a past president of the association, on the occasion of his withdrawal from the district heating business to engage in the insurance business in Chicago.

President George W. Martin announced the following committee chairmen for the coming year:

Educational Committee, J. C. Hobbs, Pittsburgh.
Underground Construction Committee, A. C. Rogers, Toledo, O.
Heating Research Committee, W. A. Wolls, Columbus, O.
Heating Research Committee, D. S. Boyden, Boston, Mass.
Public Policy Committee, W. A. Wolls, Columbus, O.
Accounting Committee, Byron T. Gifford, Grand Rapids, Mich.
Committee on Meters and Accessories, J. H. Walker, Detroit, Mich.
Editorial Committee, D. L. Gaskill, Greenville, O.
Committee on Standard Rules and Regulations, H. R. Wetherell, Peoria, Ill.
Station Operating Committee, J. L. Hecht, Chicago, Ill.

SECRETARY-TREASURER'S REPORT.

The report of the Secretary-Treasurer D. L. Gaskill, showed the association to be in good financial condition while the membership is keeping up in spite of war conditions. The total membership is 363, made up of 167 Class 1 members, 121 Class B members, 15 Class C members, 58 associates and 2 honorary members.

REPORT OF PUBLIC POLICY COMMITTEE.

The subjects covered in the report of the Public Policy Committee included "rate increases in connection with increased cost of production," "uniform formula for figuring required radiation," "special financing required on account of war conditions," "advisability of short-time contracts," "advantages of meter system for hot-water heating," "savings to be accomplished by reducing hot-water heating schedules during certain periods of 24-hour day," and "savings to be made both for hot water and steam systems by economy in the use of heating service."

No uniform formula for figuring required radiation was offered by the committee but the report recommended that the Educational Committee prepare such a rule and that district heating companies seek to have it adopted by the various courts and commissions.

On the subject of the use of hot-water meters the report states:

"It has, until now, been deemed impracticable to sell hot-water service on a meter rate basis. The reasons for this have been partly that the hot-water meters available have had moving elements made of metal which were noisy, and consequently disturbing to the customers; partly there has been the idea that even if a hot-water meter which was not noisy could be developed, it would be necessary also to measure the heat units; in other words, the temperature

of the water both entering and leaving the customer's premises.

METERS FOR HOT WATER NOW ON THE MARKET

"It now appears that some of the meter manufacturers are ready to furnish meters for measuring hot water, and that these meters are not objectionable on account of being noisy. Assuming that it is feasible to measure the amount of water circulated through a customer's premises, it is merely necessary to arrive at a fair basis of charge per unit of water circulated through such customer's premises.

"It would appear that there is little more reason why the temperature of the water need be measured at the customer's premises than there is measure the number of heat units per thousand units of gas delivered to a gas customer. Inasmuch as the cost of furnishing the heating service by the utility company depends upon the heat lost in the water between the flow and the return main at the heating company's power station, it would seem perfectly reasonable that a rate of charge per unit quantity of water circulated through the customer's premises should be on the basis of the heat lost per unit quantity of water between the flow and the return main where same leaves the heating company's station.

"This method of charge can further be simplified so that a definite charge per unit quantity of water circulated through the customer's premises can then be made on the basis of the average outdoor temperature over a period of years. Such a method of charge might well be used in conjunction with a primary charge based on the customer's required radiation and also a readiness-to-serve charge, and while such a method of charge may not be an absolutely accurate method such as, for instance, charging for a thousand pounds of steam, it is an infinitely more accurate method of charging than the present flat-rate method, which is comparatively independent of the heat withdrawn from the system by each individual customer.

"In any event, the above-proposed meter method of charging would have the moral effect of largely eliminating the big economic waste which at present exists in connection with central station hot-water heating because of the fact that same is not metered."

Educational Committee Proposes Standard Rule for Figuring Radiation.

A proposed standard rule for determining the proper amount of radiation for a building has been developed by H. R. Wetherell, of the association's educational committee, and is being sent out by the committee for suggestions and comment by the member companies. It is the committee's purpose to develop a formula that will go out as the rule of the National District Heating Association.

The committee points out that the time is coming when heating rates will be made on a "fixed charge plus" basis and where such rates are used, as the fixed charge is based on equivalent direct steam radiation, it is very important to be able to substantiate the formula for figuring required radiation. By adopting the use of "'equivalent required direct radiation," the companies using it have discontinued making comparisons of the customer's steam consumption on the basis of connected radiation, and now reduce their connected load for both direct steam radiation, atmospheric radiation and fan coils to the basis of the required direct steam radiation, and make all comparisons of consumption on this basis.

For the purpose of their monthly reports they also reduce sprinkler tanks, hot-water tanks and cooking apparatus to the basis of direct radiation. It was found in basing a fixed charge on required radiation that it would be rather difficult to substantiate figures on hot-water tanks, sprinkler tanks and cooking apparatus. They therefore planned on having two different heating rates covering the two different classes of service, one for heating only with a fixed charge based on equivalent required direct steam radiation, plus the consumption charge, and the other rate covering the consumption of hot-water tanks, sprinkler tanks and cooking apparatus which will probably be made with the minimum charge plus a consumption charge, owing to the fact that it is rather difficult to arrive at the demand on such apparatus.

The radiation rule proposed by Mr. Wetherell is as follows:

$$\text{Radiation required} = \frac{\text{B.T.U. lost per hour}}{\text{B.T.U. emitted per square foot of radiation per hour}}$$

Accompanying the rule is a table of B.T.U. losses, the majority being those used by the late Alfred R. Wolff, of New York. Another table compares the values used by different engineers, including American District Steam Company, Hoffman, Snow, Gifford, Wolff and C. R. P. & L. Co.

In using the rule it is assumed that 1 B.T.U. will heat 50 cu. ft. of air 1° F.

Then, with a temperature difference of 80 degrees,

$$\frac{80 \times 1}{50}$$

= 1.6 B.T.U. required to heat 1 cu. ft. 80°.

Good practice, states the committee, allows two changes of air per hour for all leakage losses, and 3.2 B.T.U. are required per hour per cubic foot of space. It has been found that atmospheric radiation will condense 0.21 lbs. of steam per square foot per hour.

0.21 × 965.8 = 200 (approx.) = B.T.U. given off per hour per square foot of radiation.

To compute the radiation required in any room:

First: Compute the B.T.U required to heat the air in the room.

Second: Compute the B.T.U. lost through the doors and windows.

Third: Compute the B.T.U. lost through the walls, floor and ceiling.

For atmospheric radiation, divide the sum of these results by 200 and the quotient is the number of square feet of atmospheric radiation required.

For steam radiation, (1 lb. pressure), divide the sum of these results by 250, and the quotient is the number of square feet of "straight steam" radiation required.

For hot water radiation, (water at 170° F.), divide the sum of these results by 165 and the quotient is the number of square feet of hot water radiation required.

Smokeless Boilers as an Answer to the Coal-Distribution Problem

"Smokeless" boilers, especially those of the down-draft type, designed for burning different sizes of either hard or soft coal, are today occupying a place in the front rank as the answer to the problem presented by the United States Fuel Administration of requiring the supply of anthracite, in a large section of the country to be supplemented by bituminous coal. The difficulties of burning soft coal in the ordinary type of heater are well understood and in both old and new installations it is reasonable to expect that the coming months will see an expansion in the sale of "smokeless" boilers that will mark a new epoch in the history of the heating industry.

Fortunately for the country there are a number of types of "smokeless" boilers which are well suited for complying successfully with the fuel administration's requirements, as well as having economy features that would make them an attractive commercial proposition under any conditions. Following is a list of manufacturers of "smokeless" boilers in the United States, revised to date:

LOW PRESSURE STEAM AND HOT WATER BOILERS.

American Radiator Co., Chicago, Ill.
John Brennan & Co., Detroit, Mich.
Coatesville Boiler Works, Coatesville, Pa.
Jesse C. Coogan, Milwaukee, Wis.
Federal Radiator Corporation, Newcastle, Pa.
Gurney Heater Mfg. Co., Boston, Mass.
Harrisburg Mfg. & Boiler Co., Harrisburg, Pa.
Hart & Crouse, Washington, D. C.
Herbert Boiler Co., Chicago, Ill.
Ideal Heating Co., Oskaloosa, Ia.
Illinois Malleable Iron Co., Chicago, Ill.
Kanawha Mfg. Co., Charleston, W. Va.
Kellogg-Mackay Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Kroeschell Bros. Co., Chicago, Ill.
Lord & Burnham Co., Irvington, N. Y.
Molby Boiler Co., New York
Newport Boiler Co., Chicago, Ill.
Wm. H. Page Boiler Co., New York.
Peck-Williamson Co., Cincinnati, O.
Peerless Heater Co., Pittsburgh, Pa.
Pierce, Butler & Pierce Mfg. Corporation, New York.
Frank Prox Co., Terre Haute, Ind.
Prudential Heating Co., Akron, O.
Richmond Radiator Co., New York.
H. B. Smith Co., Westfield, Mass.
Spencer Heater Co., Scranton, Pa.
Thompson Heater Corporation, Buffalo, N. Y.
United States Radiator Corporation, Detroit, Mich.
Utica Heater Co., Utica, N. Y.

FIRE TUBE BOILERS.

Ames Iron Works, Oswego, N. Y.
John Brennan & Co., Detroit, Mich.
Brownell Co., Dayton, O.
Casey-Hedges Co., Chattanooga, Tenn.
Freeman & Sons Mfg. Co., Racine, Wis.
Gem City Boiler Works, Dayton, O.
Harrisburg Mfg. & Boiler Co., Harrisburg, Pa.

Hawkes Boiler Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Murray Iron Works Co., Burlington, Ia.
John O'Brien Boiler Works Co., St. Louis, Mo.
Oil City Boiler Works, Oil City, Pa.
Titusville Iron Co., Titusville, Pa.
Vogt Machine Co., Louisville, Ky.

ACCESSORIES FOR SMOKELESS BOILER OPERATION.

Eureka Smokeless Furnace Co., Chicago, Ill. (Smokeless Furnaces)
Betson Plastic Firebrick Co., Terre Haute, Ind., (Fire Brick)

Newport Adjustable Magazine-Feed Boiler.

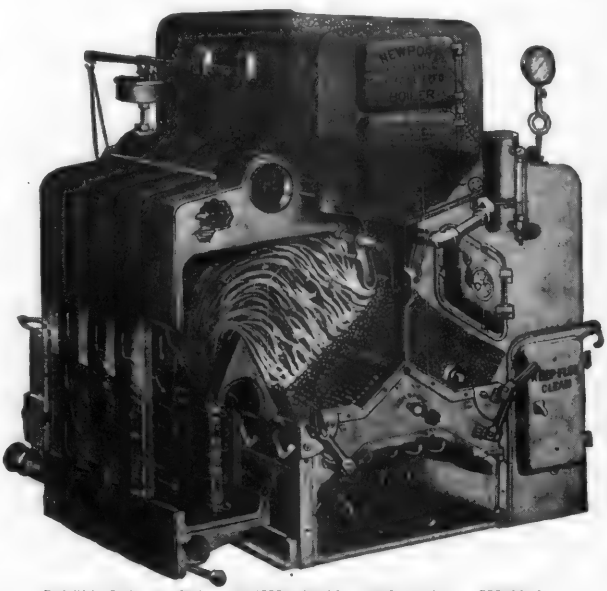
The advantages of the magazine-feed principle in heating boilers is well illustrated in the Newport boiler with its adjustable magazine throat which permits it to burn the various sizes and kinds of fuel. The idea underlying the development of this boiler was to make the advantages of the magazine feed possible in all parts of the country whatever the fuel available, and its performance during the past five years, it is stated, justifies the manufacturers' greatest expectations.

The Newport boiler burns all coals from buskwheat to range anthracite coal, coke and non-caking nut soft coals, separately or mixed. All of these coals are burned on the self-feed principle and it is claimed that even in the case of soft coal it does this with less attention and delivers a more uniform heat than the surface-feed boiler. The adjustable throat is water-cooled and to burn the larger sizes of fuel the throat is extended to form an opening as large as needed for the proper feeding. This adjustment also automatically increases the thickness of the fuel bed to the required depth for proper combustion. To burn the smaller sizes, the throat is readjusted to the narrow opening and the fuel bed is again decreased to the desired depth.

The fuel is automatically fed through the adjustable water-cooled throat onto the sloping grate at the rate required to meet the temperature condition desired and assumes the same slope as the grate, thereby maintaining an even fuel depth. The grate bars are in two pieces so that with a short stroke of the shaking handle only the lower half of the fuel bed is disturbed while with a longer stroke the upper half is also shaken. This, together with the patented grate bar, permits an even cleaning of the grates with one operation.

The Newport is designed so that the maximum amount of heating surface is exposed to the direct action of the fire. The hottest gases first come in immediate contact with the crown sheet and extensive overhanging fire surfaces. The direct fire surfaces are all self cleaning. Special emphasis is laid on the unusual heat-absorbing flue arrangement whereby the flues are located below the fire in the coolest part of the boiler. With this arrangement, it is pointed out, more heat is absorbed from the gases than is possible where the flues are in the hottest part. The flue surfaces are almost vertical and self cleaning.

All water ways, both above the fire and in the flues, are thin, vertical and unobstructed.



SECTION OF NEWPORT BOILER WITH ADJUSTABLE MAGAZINE FEED.

The return water enters the coolest part of the boiler at the rear at a point where they may absorb the greatest amount of heat possible from the flue gases. The supply outlets are located immediately above the direct-heating surface at the front and at the hottest part of the boiler, to promote rapid circulation throughout the boiler and the greatest possible heat absorption.

The boiler is designed so that the magazine is external to the boiler proper. With this arrangement essential heating surface is not sacrificed for fuel-carrying capacity. The magazine capacity it is stated, is double that of any other boiler of this type which makes coaling necessary only once a day in the coldest weather and from two to three times

a week in ordinary weather. The ashpit is unusually large and high, being designed to carry several days' acumulation of ashes without danger to the grates.

Another exclusive feature of this boiler is the ashpit spray which sprinkles the ashes to eliminate dust in their removal. Both steam and water boilers are furnished with metal diaphragm regulators which automatically operate the revolving combined draft and check damper in the draft box at the rear.

The return inlets are 4½ in. above the floor level permitting the boiler to be used for heating garages, greenhouses and other isolated buildings. The water line of the largest sizes is only 40½ in. above the floor level.

The Newport boiler is of the cast-iron sectional type and is made by the Newport Boiler Co., Chicago, in a variety of sizes for both steam and water.

Molby Magazine-Feed Down-Draft Boiler.

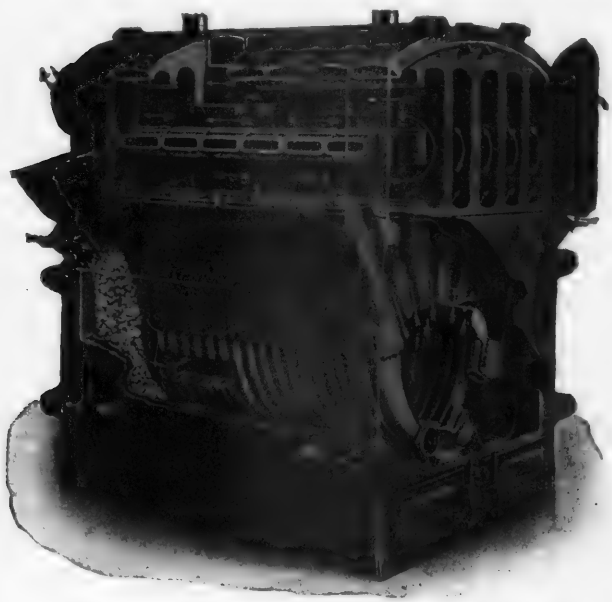
A heater that is successfully meeting the requirements for conserving coal and labor is the Molby magazine-feed down-draft boiler, which is designed to burn both anthracite coal of various sizes from pea to stove, and free-burning bituminous coal 2 in. and smaller.

The Molby boiler is built on the down-draft principle of combustion and has two grates, a water grate and a shaking grate practically at right angles to each other. The water grate is formed by water sections with gas ports between and lies along the side of the fire. The shaking grate is at the bottom of the fire and is horizontal. The coal is fed through a magazine at the top of the fire and feeds gradually down into the fire-pot, as the coal is burned away beneath.

The magazine-feed provides a residue of coal to carry the fire for long firing periods. The draft is taken in under the magazine and the air supporting combustion passes downward and through the fire. As the gases are released from the coal they pass downward and through a water grate to a combustion chamber where in flowing through at a high velocity they are thoroughly mixed and consumed.

The soot and smoke from the coal is consumed by being pulled downwards through an incandescent body of fire and the other combustible and heat-giving products of the fuel are consumed in the fire-box of the heater. The gases burn out into the combustion chamber in a flame and pass over the large heating surfaces of the boiler, to give the greatest possible heat absorption and efficiency.

The fire is always kept opposite the water-grate and above the tops of the gas ports in order to keep the combustion end of the fire and the combustion chamber always at a high temperature. The steam pressure and the temperatures, it is stated, do not drop when coal is added to the fire, but a constant temperature is maintained. For this reason it is never necessary to rush the fire after every firing period to make up the losses through firing and it prevents loss of fuel through unburned gases.



CONSTRUCTION OF MOLBY BOILER, SHOWING MAGAZINE FEATURE.

With the down-draft boiler it is necessary to have a tight chimney flue of proper area and height. The boiler should be ample to take care of the load easily. The boiler should be carefully set and cemented to prevent the short circuiting of the gases or the taking in, to the boiler itself, of large quantities of cold air. The air supporting combustion should pass through the fire and through the water-grate. The boiler should receive proper care and attention. Fifty per cent of the labor in attention, however, is saved over the ordinary boiler on account of the magazine-feed feature.

The adjustable magazine feature of the Molby boiler is such that it can be readily adjusted for burning anthracite coal from pea to stove size. Larger sizes of coal than

this are not desirable for low-pressure heating. The magazine that is suitable for pea coal will not readily feed nut or stove size. In burning bituminous coal only the free-burning variety, the manufacturers state, should be used in a magazine-feed boiler. The best coal is always the cheapest. The results of any installation are proportionately good or bad depending upon the heating value of the coal used and the chimney drafts. The capacity of the boiler depends on the quantity of coal that can be properly consumed. This depends on the size boiler and the chimney draft. A down-draft boiler properly set and with a good chimney, it is stated, provides the highest efficiency and the greatest economy in operation. A boiler of this principle should release and burn the gases thoroughly. The mixing of gas and oxygen is accomplished as the gases pass into the combustion chamber under good draft at a high velocity. The saving of fuel and labor may be such that the installation of one of these boilers becomes an investment paying many times the legal rates of interest on the capital invested.

This heater is manufactured by the Molby Boiler Co., Inc., 101 Park Avenue, New York. The 31-in. and 47-in. sizes have two distinct fire pots and magazines. One side only need be fired in mild weather.

A Boiler with Two Combustion Chambers and Two Grates.

Among the noteworthy features of construction of the Monarch down-draft smokeless boiler, manufactured by the Wm. H. Page Boiler Co., New York, are *its two combustion chambers and grates, one directly above the other.* The upper chamber is supplied with green bituminous coal which, burning downward through the grate, disintegrates as it ignites, liberating its volatile gases, the resultant incandescent coke dropping upon the lower grate where it continues to burn. Additional air is drawn upward through the lower grate and through this incandescent coke bed where it unites with the gases from the upper grate. In this manner a hot mixture of the proper proportions may be obtained for complete combustion.

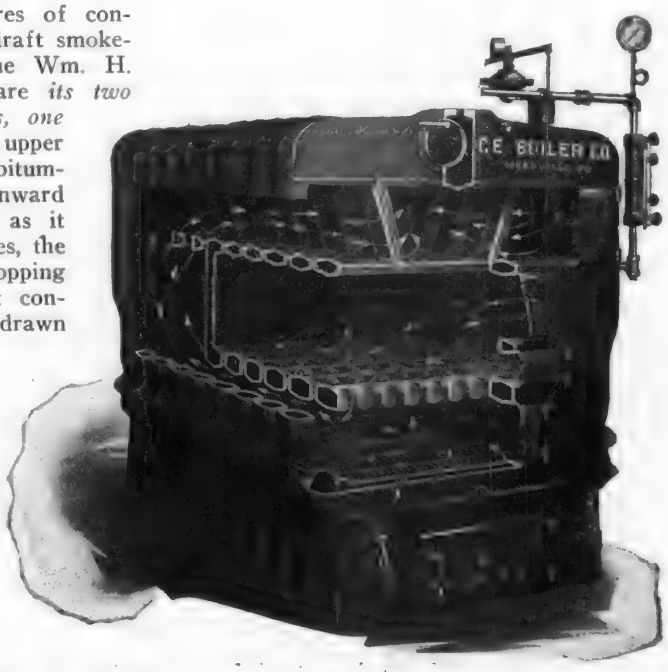
These gases then pass back of the bridge wall section where they turn upward and pass to the front through the two outer boiler flues and again to the rear through the center flue to the smoke pipe, thereby the heat units are absorbed by the heating surfaces of the boiler.

The emission of smoke shows that these rich gases are not being thoroughly consumed, escaping unburned up the chimney, as is evidenced where soft coal is burned in the ordinary up-draft boiler, it being impracticable in such types to supply the rapidly liberated gases with sufficient air pre-heated to the proper temperature to ignite and consume them thoroughly.

The upper grate is cast integral with the boiler section, each bar being hollow the same as the boiler section of which it is a part. The inside area is ample to provide for free circulation and every part is backed by water to prevent its burning. The spaces between the grates and their hollow projections are proportioned to allow for the passage of the requisite supply of air for complete combustion.

The water grate also forms an effective part of the heating surface in the boiler.

In the operation of this boiler no fuel supply is required for the lower or secondary grate, the upper only being charged and an occasional slicing through the openings provided in front section on a level with the grate is all that is necessary to maintain an even fire. The lower grate should be shaken occasionally to relieve it of accumulated ashes.



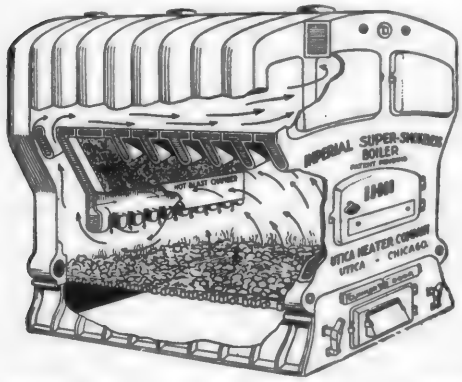
MONARCH DOWN-DRAFT SMOKELESS BOILER.

Imperial "Super-Smokeless" Boilers.

What is described as the latest development in low-pressure cast-iron boiler construction is embodied in the Imperial "Super-Smokeless" Boiler, manufactured by the Utica Heater Co., Utica, N. Y. This boiler, it is pointed out, combines simplicity of construction and design with efficiency, ease of operation with economical results, and elimination of objectionable smoke with the use of even the cheapest grades of coal. It is also adapted for burning hard coal or coke.

As will be noticed from the illustration, the Imperial "Super-Smokeless" boiler is an updraft single-grate type of boiler. The rear of the firebox is formed by a hollow baffle or "water curtain" section surfaced with a special high-fire-test cement, which, it is stated, will stand a much higher temperature without fusing than it could ever be subjected to in a heating boiler.

The products of combustion rise in the firebox, coming into contact with the direct



CONSTRUCTION OF IMPERIAL SUPER-SMOKELESS BOILER.

overhanging fire surface, thence flow toward the rear and strike against the super-heated surface of the "water-curtain" which serves also to break up many of the soot particles.

As soot and smoke consist largely of carbon, it is important that a high temperature of this carbon and of oxygen be obtained at the moment of union. In the Imperial boiler, this is accomplished by its hot blast chamber. Adjustable inlets on each side of the heater allow cold air to enter at both sides of the boiler. This air, after being intensely heated, is injected into the combustion chamber at a point where it will meet the smoke and soot just as they leave the baffle wall, broken up in a condition where they will readily combine. The manufacturers characterize the result as "the most nearly perfect combustion that has ever been obtained." A white flame is produced which travels through the flues, taking the place of the unburned gases in the ordinary type of boiler. These hot gases in their travel ignite or burn any un-

TILE FIRE WALL IN IMPERIAL BOILER WHICH SERVES TO BREAK UP SOOT PARTICLES.

consumed gases, superheat the steam and serve to keep the flue surfaces clean.

These boilers are made in a wide range of sizes for both steam and water.

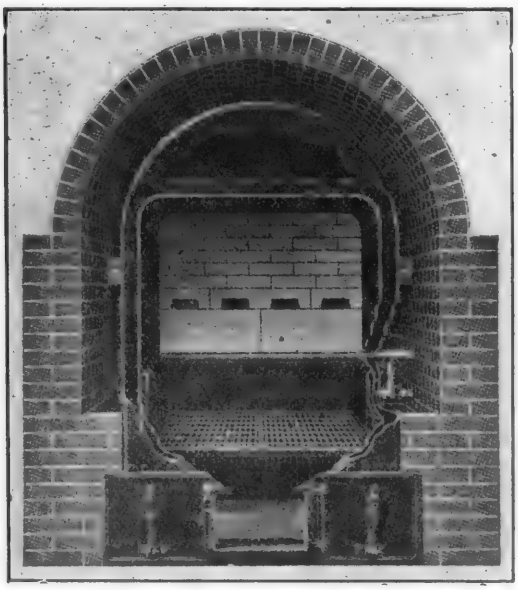
The Use of Intensely Heated Air to Accomplish Smokeless Combustion.

It is times like the present in which nations check up on their extravagant and wasteful methods that give added value, in the eyes of the public, to devices of conservation and increased efficiency. The small percentage of available heat units in a ton of coal which we have utilized, although long a subject of study and discussion by engineers, has been largely ignored by the public. The public has been absorbed in other matters. Money has been comparatively easy to obtain and the public has "muddled through," as a rule, leaving the matter with the engineers.

Smoke with its dirt and waste has been the subject of law-makers and economists for years, but smoke is still with us. Now, however, the situation has changed. The nation must husband its resources of which coal is one of the most important. The nation must cut out losses, both in health and materials, caused by smoke.

Applied science has found the key to the problem in the conditions under which air enters the fire-box of the furnace and how it is handled after it is in there.

Cold air is not burnable. Intensely heated is instantaneously combustible and, when

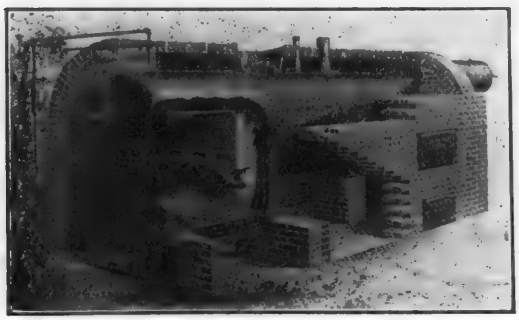


EUREKA SMOKELESS FURNACE INSTALLED IN ORDINARY FIRE-BOX BOILER.

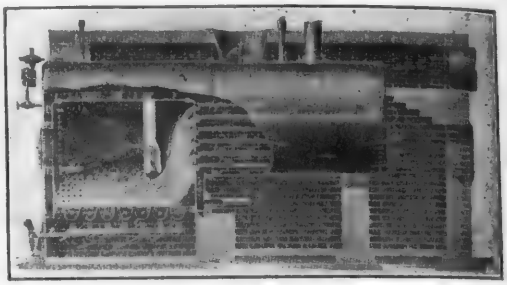
mixed with coal gases, bursts into almost incandescence, so intense is its heat. This is not a new principle in heating; it is an old one, but one which has been only partially or indifferently applied.

One device which harnesses this law into workable form is the construction of the fire-box interior, known as the Eureka smokeless furnace. This device has been on the market for the past three years and the manufacturers state that the severest comparative tests by engineers and architects has produced increased proofs of the value of the device for the better utilization of coal and the prevention of smoke in soft coal combustion.

It will be noted in the construction of this furnace, which is shown in the accompanying illustrations, that the hot air is not only distributed over the coal bed, but is also injected into the gas chamber back of the hollow Eureka fire-wall, where all the gases become ignited and consumed at a high temperature, before entering the boiler tubes.



EUREKA SMOKELESS FURNACE IN OPERATION.



ARRANGEMENT FOR ADMITTING SUPERHEATED AIR TO COMBUSTION CHAMBER OF EUREKA SMOKELESS FURNACE.

This device is manufactured by the Eureka Smokeless Furnace Co., Chamber of Commerce Building, Chicago, Ill., and the company writes that engineers and architects have a great opportunity to make a decided "hit" with their clients by specifying the Eureka smokeless furnace for their clients' use.

Plastic Fire Brick as a Substitute for Blocks or Bricks Requiring Mortar.

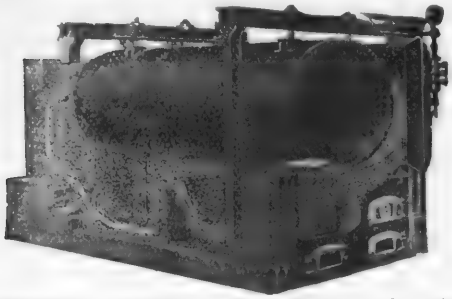
In view of the scarcity of brick blocks considerable interest attaches to the use of Betson's plastic fire-brick for making boiler furnace linings. This product is described as superior to blocks or bricks which require mortar and which are likely to fall out, permitting air in leakage.

BETSON'S PLASTIC FIRE BRICK BEING APPLIED WITH MALLET. IT IS SMOOTHED WITH A TROWEL.

In house heating boilers, as well as for

other kinds of boilers, plastic fire-brick has been found to be a money-saver. It is especially designed for forming jointless, one-piece furnace linings in new or old settings. It is made of selected refractory materials and is subjected to a special mechanical preparation to eliminate expansion and contraction from temperature changes, thus making solid monolithic linings possible. It comes in barrels in a moist, plastic condition ready for use.

A further advantage of this product is that



BETSON'S PLASTIC FIRE BRICK AS USED FOR LINING OF FURNACE OF RETURN-TUBULAR BOILER.

anyone can apply it, as it is an easy matter to make the forms, while sometimes forms are not needed. After taking out the former lining of fire brick, a lining of Betson's is built up to the same thickness by placing it in chunks, consolidating it with a mallet and smoothing with a trowel. After a few hours' drying with a light fire, the lining is ready for regular hard service.

The complete Betson lining has no joints to leak air and gases, no fire clay or mortar to break and fall out and no bricks or blocks to crack or spall. Injuries to side walls by firing tools, it it added, do not weaken the lining as a whole and are easily patched. This material is also used as a substitute for special forms of bricks or blocks as, for example, where the front headers of horizontal water-tube boilers rest upon the front arch. It is also used for front arches, side walls, bridge walls, rear arches, and baffles. The manufacturer is the Betson Plastic Fire Brick Co., Rome, N. Y., and the company states that its product is carried in stock in all of the principal cities of the United States and can be obtained quickly.

House Heating with Kerosene.

HEAT YOUR HOUSE WITH KEROSENE is the advice contained in a circular issued by the Doble-Detroit Steam Motors Co., Detroit, Mich., devoted to the Doble system of heating with kerosene oil. This system is designed to burn liquid fuel in an atomized condition. It can be used, it is stated, in any type of house-heating apparatus. The apparatus consists of a small combustion chamber, which is placed in the ash-pit space of the furnace. A cast-iron pipe bolted to the combustion chamber projects through the ash pit opening. The blower assembly is bolted to a flange on the cast iron pipe connecting with the combustion chamber.

The motor to drive the blower is bolted to the blower casing. A small float chamber alongside of the blower receives the fuel by gravity from a tank which may be placed in any convenient position in the cellar. By arranging the tank near a window it can be filled from outside the house.

A small pipe line from the fuel tank conveys the fuel by gravity to the float chamber.

A connection from any electric light socket furnishes current for the motor which drives the blower. The blower takes air through the inlet opening and feeds the air at high velocity through the outlet passage of the blower. In the outlet passage a fuel nozzle is located, the stem of which is connected with a pipe from the float chamber. As the forced draft of the blower rushes through the fuel nozzle it draws the fuel from the float chamber and feeds a continuous spray of oil into the combustion chamber. The fire is started by a gas pilot light located in the combustion chamber.

A thermostat, placed in one of the upper rooms, regulates the fire according to the desired temperature. When the room temperature reaches the point at which the thermostat is set to operate, the electric circuit to the motor is broken so that the blower stops feeding fuel into the combustion chamber and the fire goes out.

When the room temperature drops and the thermostat again makes the electric contact to the motor, the fuel is ignited by the small pilot light in the bottom of the combustion chamber.

The fire is therefore turned on and off automatically, depending upon the variation of the room temperature, and requires no attention after the first lighting of the fire.

The circular also gives some cost figures compared with coal, taking 1 lb. of coal at 10,000 B. T. U. and 1 lb. of kerosene at 19,832 B. T. U. On this basis the cost of 15 tons of coal at $10.50, together with the care of the furnace and removing ashes during six months, would come to $217.50. For the same period and service 1793 gal. of kerosene at 12 cents per gallon would be needed. This would come to $215.16 to which should be added electric current for six months amounting to $12.00, or a total cost of $227.16.

Automatic Draft and Temperature Regulation a Cure for Fuel Waste.

Very few house holders really enjoy the maximum economy and efficiency of their heating plants. Many owners think they are

SPRING MOTOR USED WITH HONEYWELL SYSTEM OF AUTOMATIC DRAFT AND TEMPERATURE REGULATION.

getting the most out of the fuel they burn, but have been greatly surprised at still further fuel economy that they have accomplished by the use of a more sensitive method of regulating the burning by the constant supervision of the draft adjustments. This is possible by the thermostatic system of draft regulation.

Fuel waste in burning occurs during those

Front. Back.

EIGHT-DAY CLOCK THERMOSTAT USED WITH HONEYWELL SYSTEM OF AUTOMATIC DRAFT AND TEMPERATURE REGULATION.

forgotten periods when some one leaves the drafts a little too long or doesn't turn them on soon enough to meet the changing condition of the weather. Too much air through the fire will speed it up and it soon gains in momentum. Its lively burning will either rapidly consume all the fuel in the fire pot or require more to be thrown on, so that a large quantity of fuel and heat is unnecessarily used before the fire is reduced to the normal rate of burning.

Again, when the weather turns cold and drafts are not turned on promptly enough, the fire may smolder low and even go out, requiring additional unnecessary quantities of kindling and coal to rebuild the fire, with discomfort in the meantime.

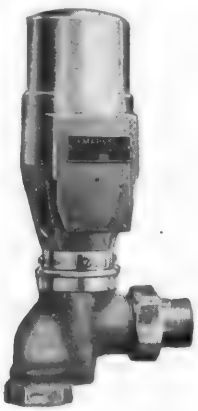
The automatic temperature regulator establishes a thorough co-operation between outside weather and inside temperature and the rate of burning fuel. The temperature regulating devices offered today on the market have reached a very high degree of perfection. They have many very desirable features, such as turning off the drafts in the evening and turning them on again in early morning so that the house shall be comfortable at rising time.

The motors which operate the dampers are made to run by gravity, clock spring, or electricity. The present-day thermostat which regulates the temperature in the rooms and telegraphs the orders down to the motor operating the drafts of the boilers, are exceedingly accurate and efficient. A difference of one degree in the temperature of the room from that required by the thermostat will affect its sensitiveness and turn on the drafts so that the fire in the boiler may catch up.

The installation of automatic draft regulation on any boiler or furnace is a guarantee of fuel savings. The selling of such devices as these this year is in accord with the suggestions of the United States Fuel Administration which in its bulletins emphasizes very strongly the great benefits of automatic draft and temperature regulation.

Marvel Motor Valve.

The accompanying illustration shows the Marvel Motor Valve, described in the Au-



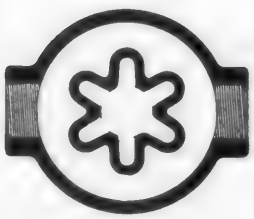
MARVEL MOTOR VALVE.

gust issue, for radiator and valve control. It is made by the American Thermostat Co., Newark, N. J., and consists of a Gorton type quarter-turn packless cone valve to the post of which is directly connected the master Marvel Valve Motor, non-reversing and universal, operating on either alternating or direct current of 110 volts. Where steam or hot water circulation is constant, it is possible with the device to control individual radiator units or a connected system of units when used in connection with the company's system of temperature regulation.

Heating Garages by a New Method.

What is described as the first successful device by which a garage can be heated by hot water from a steam or vapor boiler located in the residence, has been brought out by the Excelso Specialty Works, Buffalo, N. Y. The Excelso method, as it is called, is also used with success in heating water for domestic use with or without thermo-

EXCELSO WATER HEATER.

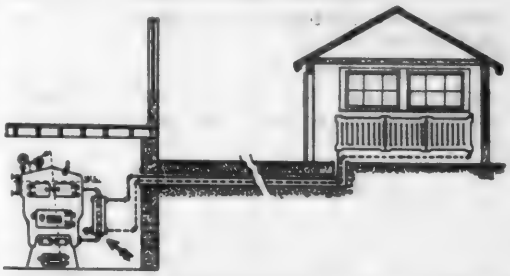


SECTIONAL VIEW OF EXCELSO WATER HEATER, SHOWING INTERIOR CONSTRUCTION.

static control. Its cost is said to be far less than installing a coil and manhole in a storage tank. It can also be used with or without the storage tank, either singly or in multiples.

The Excelso water heater itself is a one-piece casting having two separate chambers. It has an inner wall of corrugated form to give extended heating surface. The water circulates through the outer chamber and is heated by steam or boiling water in the inner chamber.

For heating garages an important feature of its usefulness is in such cases where direct underground steam lines to the garage are higher than the water-line in the boiler. Where such conditions are met the heater may be connected to the residence boiler and the hot water pipes run underground to the



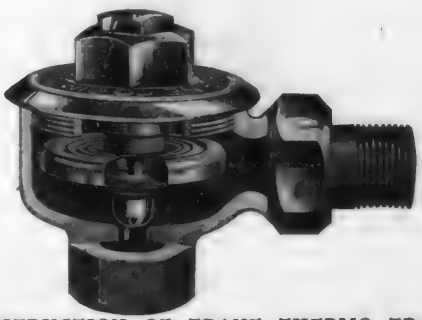
TYPICAL INSTALLATION OF EXCELSO METHOD FOR HEATING GARAGE.

garage radiation, using either city pressure, an expansion tank in the house or garage, or loops. Users are advised to install at least one heater below the water-line of the boiler in the residence. If additional capacity is required it may be installed above the water-line and live steam used to heat the water. This method of installation, it is pointed out, prevents freezing, because the heater installed below the water-line is always working even though there is no steam in the boiler or the fire is banked.

The heater is made in four sizes. Where steam at 5 lbs. pressure is used and the water is heated from 45° to 155° during a three-hour period the tank capacities of each heater range from 40 gal. to 400 gal.

New Features Embodied in Trane Thermo Traps and Vents.

A steam trap which is being widely used for new installations and especially for remodeling work in factories, is made by the Trane Co., La Crosse, Wis., and is known as the Trane thermo trap. A unique



CONSTRUCTION OF TRANE THERMO TRAP, SHOWING SELF-ALIGNING STEM INSIDE DIAPHRAGM.

feature of this valve, which is shown in Fig. I, is its distinct type of diaphragm which is self-aligning, as well as adjustable. The expansion member is a 2 in. metal diaphragm made of phosphor bronze. It is filled with a sensitive liquid which leaves the diaphragm normally compressed and

gives a maximum expansion of about 3-16 in. The self-aligning stem inside the diaphragm serves to prevent the stem from getting out of alignment either on the job or through rough handling in shipping besides giving assurance that the plunger will seat properly when the job is in operation.

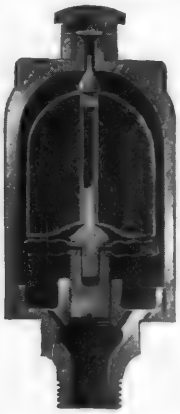
Another notable feature of this trap is the outside adjustment by which any desired readjustment may be secured while the system is in operation by removing the plug on top of the valve and, with a screw driver, turning the diaphragm to any position.

The seat in the Trane trap is beveled and is below the floor of the trap which slopes down to it on all sides, making it self-cleaning. The action of the diaphragm is described as quick and positive.

Trane Exhaust Air Valve and Float Vent Trap.

A new device known as the Trane air exhaust valve has recently been developed by the Trane Co., replacing the thermo trap used on top of the Trane receiver. It is found that its design makes it better adapted for venting large volumes of air freely and preventing the escape of steam.

The valve is made with the well-known Trane phosphor-bronze diaphragm with the



SECTION OF TRANE FLOAT VENT TRAP.

valve seat on top. The long plunger motion accounts for the free venting of large volumes of air. While there is little resistance to the escape of air past the aluminum disc resting on a seat, it serves as a check in preventing air from passing back into the system.

To meet the demand for a valve which will prevent the escape of water, besides accomplishing all that the air exhaust valve does, the company has developed a device known as a float vent trap. A valve of this kind is useful in places sufficiently above the water-line to make the volume secured by the use of a receiver unnecessary. Also vapor systems for disconnected garage buildings with overhead systems, no basements, etc., can be better designed by using a valve of this kind. It is also valuable for improving the operation of poorly-designed, straight steam plants by connecting it on the end of the main return.

This valve has simply the sliding float in addition to the features of the air exhaust valve.

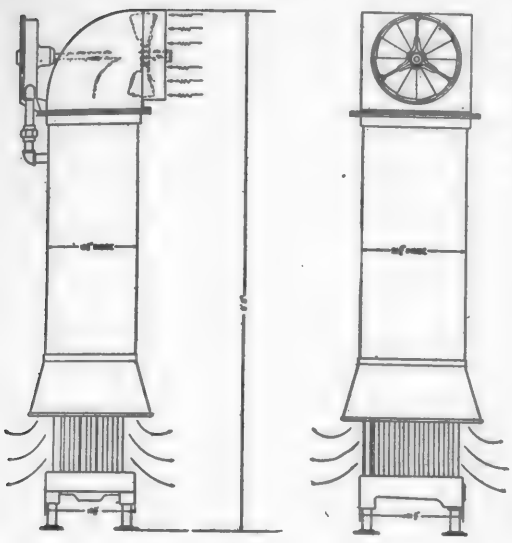
As shown in the illustration the large brass float with the hollow tube rest and slides upon the diaphragm pin so that the float can rise independent of the diaphragm or be forced up by it to close the plunger against the seat. Either steam striking the diaphragm, or water lifting the float will close the valve. Air has easy passage through the large ports for venting. The aluminum disc is used here also to prevent air entering the system.

Unit Portable Hot-Blast Heaters.

In discussing the use of unit hot blast heaters, at the recent summer meeting of the heating engineers' society, a description was given of the "ABC" unit heater. This heater is so built that air from within the room can be recirculated or a pipe can be attached to extend through the wall or through the roof to heat and circulate fresh air. The heaters are especially useful, it is stated, for heating additions to buildings where it is not practicable to extend the main heating system and for similar special cases.

The base of the heater is divided by a partition in the center, making two separate chambers, one for the live steam side, the other for the return. There is an internal water-seal at one side of the base to prevent the steam from blowing into the return side before passing through the pipes. Into the top of this base is screwed a nest of steam pipes which are built up in return loops. The disc fan at the top is driven by a small impulse turbine mounted on a bracket outside the jacket. Steam is admitted to the intake of the turbine and passes from the turbine and exhaust pipe into the heater base, thus using the steam for heating.

These heaters, which are made by the American Blower Co., Detroit, Mich., are furnished in capacities ranging from 1790 to 2070 C. F. M. with corresponding B. T. U. per hour of 180,000 to 236,000, and with

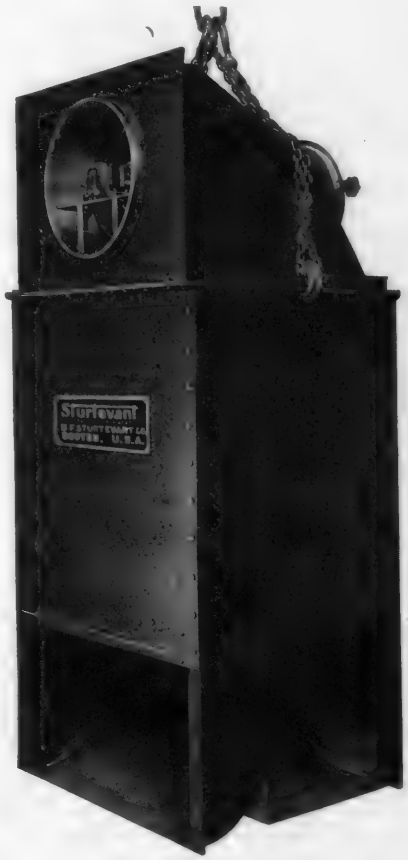


ABC UNIT HOT-BLAST HEATER.

steam pressures ranging from 40 to 100 lbs. gauge. Where desired the fan may be driven by motor or by belt.

Another type of unit heater described at the same meeting is the Baetz air heater, manufactured by Skinner Bros. Mfg. Co., St. Louis, Mo. As will be noticed from the illustration this heater is constructed of steel plates and angles. The upper part is occupied by coils of steam pipe, arranged so that they may readily be removed for repairs. A blower is placed beneath them in the same enclosure. Air is drawn in by the fan from two sides and is forced upward against the steam-heated coils, passing out at the top as heated air. A convenient line shaft, a small engine or a motor may be used to propel the fan. The illustration shows where the steam and return connections are made. The point is made that when a small steam engine is used for driving the fan the exhaust steam from the engine can be piped direct into the heater coils.

BAETZ AIR HEATER, SHOWING FAN AND HEATING COILS.



STURTEVANT UNIT HOT BLAST HEATER.

The Baetz heaters, it was stated, are in successful operation in many large foundries and industrial plants.

Still another type of unit heater, not described at the meeting, is manufactured by the B. F. Sturtevant Co., Hyde Park, Mass.,

and is also illustrated herewith. This unit is equipped with a turbine-driven disc fan and discharges the heated air at the bottom along the floor. It is especially recommended for heating shops, roundhouses, and industrial buildings. The Sturtevant individual heater unit requires but one steam pipe and is arranged so that the exhaust steam from the turbine may be used in the coils.

This heater consists of a disc fan mounted on the top of a sheet-metal casing and arranged to discharge the air down across Vento radiation enclosed in the casing. The outlet discharge is at the bottom and is designed to discharge the air in a horizontal direction along the floor.

The fan is arranged for operation by a direct-connected motor, direct-connected steam turbine, or by pulley for belt drive. The fan wheel is of the multi-blade type, disc fan 26 in. in diameter. The capacity at 2,020 r.p.m. is 6650 c.f.m. The heating surface consists of 376¼ sq. ft. of 40 in. American Radiator Vento which will heat the air from an entering temperature of 60° F to a final temperature of 128° F., causing the condensation of approximately 500 lbs. of steam per hour, steam entering the heater at 5 lbs. pressure.

Steam Traps as Fuel Savers.

Some interesting examples of coal saving by the use of steam traps and similar appliances are reported by the Farnsworth Co., of Conshohocken, Pa., manufacturers of the Farnsworth line of condensation utilities. In one paper mill the use of these devices, it is stated, has increased the production and decreased the coal consumption about 4000 tons per year, while in one textile mill four tons of coal per day were saved out of eleven tons formerly burned. Farnsworth apparatus, it is stated, is being successfully used in nearly all of the large Government camps, especially in the camp laundries where duplex boiler feeders are installed for draining the high-temperature condensation and feeding it directly into the boilers, and pumping condensation under various conditions. In many such plants the condensation is being fed into the boilers at temperatures over 300°.

In this particular machine one chamber is always in a receiving condition while the other chamber is always under boiler pressure. It is usually placed on top of the boiler or in any convenient place above the water-line of the boiler. All of the high-pressure traps discharge through one common return directly to this duplex boiler feeder. The alternate filling of the receiving chamber and the delivery of condensation from the delivery chamber operates the control valve of the machine which feeds the water into the boilers. This method provides a closed system between all high-pressure traps and the boiler, serving to hold the condensation that is in the high-pressure traps under pressure, thus retaining the heat units.

Should any of the high-pressure traps leak, there would still be no loss as the steam or condensation would only be discharged into the closed return line.

When the same plant is serving a heating system the company recommends the use of its duplex condensation pump which is designed to drain the condensation from the low-pressure heating mains, or heated apparatus of any kind, and to pump this condensation directly into the receiving chamber of the boiler feeder, along with the condensation from the high-pressure traps. In operation the receiving chamber of the condensation pump is equalized with the heating system or heated apparatus, return lines, etc. As the chamber fills it oscillates and operates the control valve which, in turn, applies full boiler pressure on the top of the low-pressure condensation. This, of course, pumps the condensation out and into the receiving chamber of the duplex boiler feeder.

The company's complete line includes condenser vacuum pumping machines which are remarkable for the high vacuum they maintain, making them adaptable for clearing sluggish return lines or for pulling condensation out of blast coils where there is frequently a tendency toward vacuum, due to the cold air being blown over them, which holds back the condensation in the coils.

FARNSWORTH PUMPING TRAP, ILLUSTRATING THE FARNSWORTH STEAM TRAP PRINCIPLE.

The company also manufactures several types of single-acting pumping traps and variable-pressure traps which form a combined separating and pumping trap, also separating traps for draining high-pressure steam lines

and heating apparatus. The Farnsworth high-vacuum separating trap, the company states, is doing excellent work draining lines carrying a high vacuum between the engine and condenser. In the use of these traps it is possible not only to collect this condensation under a high vacuum, but to pump it to any point of use with a high-pressure steam connection.

New Publications.

FRICTION OF WATER IN PIPES AND FITTINGS, by Professor F. E. Giesecke, head of Division of Engineering, Bureau of Economic Geology and Technology, University of Texas, has just been published and will rank as one of the most important publications of the year for the heating engineer. The bulletin describes in detail a series of experiments made at the University of Texas to determine the friction of water in pipes and fittings, with particular reference to the application of the developed data to the design of hot-water heating systems. The experiments described show that the friction of water decreases as the temperature of the water increases and that, for ordinary ranges of temperature, the friction of water in one foot of new and clean black pipe is

$$\frac{0.01533 v^{1.77}}{t^{0.19} d^{1.275}}$$

feet of water of the same temperature as that flowing through the pipe; t being the temperature of the water in Fahrenheit degrees, v the velocity of the water in feet per second, and d the internal diameter of the pipe in inches.

The experiments also show that the friction of water in galvanized iron pipe is slightly greater than that in black pipe, that it is somewhat greater in used pipe than in new pipe; that the friction in drainage elbows is considerably greater than in ordinary elbows, and that the relation between the friction in short radius and that in long radius elbows is quite variable; that the friction due to unreamed ends is relatively much greater in small pipes than in large pipes, and other interesting facts.

A copy of the bulletin may be secured by writing the chairman of the Committee on Publications, University of Texas, Austin, Texas.

ANALYSIS OF MINE AND CAR SAMPLES OF COAL COLLECTED IN THE FISCAL YEARS 1913 TO 1916, are given in Bulletin 123, issued by the Bureau of Mines, being a continuation of the reports on the sampling and analyzing of the coals of the country begun by the government in 1904. It is the third of the series. Bulletin 22, "Analyses of Coal in the United States," which can now only be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C., for 85 cents, is the first. The second bulletin of the series, Bulletin 85, "Analyses of Mine and Car Samples of Coal Collected in the Fiscal Years 1911 to 1913," is still available for distribution by the Bureau of Mines. Copies of Bulletin 123 may be obtained free of charge by addressing the Director of the Bureau of Mines, Washington, D. C., as long as the present edition remains.

Trade Literature.

TRICO HUMIDIFIER, consisting of a reservoir or water container to be located directly above a radiator, is featured in a new catalogue entitled "Humidity," issued by the Art Metal Radiator Cover Co., Chicago. This device it is stated, may be adjusted to fit any radiator. It is made of galvanized metal, is 1¼ in. deep and extends over the entire length and width of the radiator. It is made so that part of the hot air passes through perforations in the side of the container near the top and thence over the water's surface, carrying the rising vapor through an aperture in front. The art metal top is made of No. 12 gauge pickled steel. Exact imitation of any wood desired is furnished. The container is filled with water by hand through a butterfly trap at one end.

G. F. E. RECTOR SYSTEM DATA SHEETS, prepared by the Gas Heating Department of the General Fire Extinguisher Co., Providence, R. I., and having special reference to the G. F.E. Rector system of gas-heated radiators, are a noteworthy contribution to recent heating literature. Those published up to date comprise some 49 sheets and cover, in addition to details of the Rector system, methods of estimating for the installation of this system, computation of gas consumption, selection of radiation, installation of radiation, piping (general), gas piping, vacuum piping, and gas valve adjustment. The data sheets supplement the company's catalogue on "Heating de Luxe Made Plain," which is a technical explanation, with illustrations, of the G. F. E. Rector system. A special binder is furnished for the data sheets to hold additional sheets as issued.

RORAL HUMIDIFYING RADIATOR SECTION is a unique device made by C. C. Shipp & Co., Indianapolis, Ind., and described in one of

the company's recent circulars. It is practically a removable-top humidifying radiator section. It holds 10½ lbs. of water which evaporates into the air of the room through a slot in the removable top or cap. In addition to the humidifying section itself, the company uses a device known as the D-1 automatic supply and air release which is designed to eliminate the need of an air valve on the radiator, automatically controlling by its own action the circulation of steam

RORAL HUMIDIFYING RADIATOR SECTION, SHOWING AUTOMATIC SUPPLY AND AIR RELEASE VALVE SUBMERGED-

through the sections of the radiator. The operation of this valve is intended to constantly withdraw steam from the live sections of the radiator and condense it by means of a condensing coil, thus keeping all sections filled with live steam.

War Savings Societies.

Our readers have been invited to "back up" our soldiers at the front by joining or forming a War Savings Society. Full information will be supplied upon addressing the War Savings Society Bureau, 51 Chambers Street, New York City, or the National War Savings Committee, Washington, D. C.

How Much Money Does a Soot Cleaner Save?

Some interesting computations have recently been made by the Vulcan Soot Cleaner Co., Du Bois, Pa., showing that a soot cleaner saves more money during its lifetime than is generally supposed. The computations have been simplified to "savings per feet of pipe." Thus they show that each foot of pipe used in connection with a permanently-installed soot cleaner saves approximately 18.3 tons of coal during the lifetime of the cleaner. In addition, each foot of pipe saves one man's labor for one day. If we assume the price of coal to be $4.00 per tone and 200 ft. of pipe per cleaner, the money saved for the lifetime of the cleaner will be $4.00 x 18.3 x 200 = $14,600. Add to this the boiler-room labor wage ($2.00 per day x 200 days, the average life of the cleaner) and we get a total saving of $15,000. These figures are based on boilers operated at 140%, average coal consumption 4 lbs. per B. H. P. per hour, boilers operating 24 hours per day, 325 days per year.

New York Steam Company in Receivers' Hands.

As a result of war conditions, resulting in the greatly-increased cost of materials, the New York Steam Company, which supplies steam for power and heating purposes in both the uptown and downtown districts of New York, has been placed in the hands of receivers. Those named are G. C. St. John, former president of the company; George F. Hurd and William P. Fitts. The receivership was the direct result of a mortgage foreclosure suit brought by the Andrews Institute for Girls at Willoughby, O., which is one of the principal owners of the company.

In the order appointing the receivers Judge John C. Knox of the Federal District Court said:

"The New York Steam Company is presently unable to meet and discharge its obligations which have already matured and those which are maturing. It is unable to carry on its ordinary business with safety to the public and advantage to its stockholders; and it is in the intereset of the defendant steam company and the bondholders, creditors and stockholders of the defendant company that receivers of all its property and assets be appointed."

The liabilities of the company are said to total, roughly, $4,750,000 of bonded indebtedness and $800,000 in accounts payable. Current assets are given as $801,357.16, and lia-

bilities, including mortgages and current debts, as $5,919,206.07.

It is expected that the present organization will remain intact and the business continue as heretofore.

Business Still Lives!

The supreme factor in American business today is the government. Through its power to regulate the distribution of fuel and materials it controls practically all the industrial activity of the country. Through its military and industrial powers it affects all labor. By price-fixing it controls mining and important agricultural operations. By licensing and priorities it controls traffic on both land and sea. It operates railways, shipyards, munition plants. It owns navy yards, armories, gun factories, powder plants, a security-issuing corporation.

An unprecedented degree of the power of industry has, because of a people's passion for victory, been willingly given up to those in authority over us. Yet business lives. The government desires it to live. The government calls upon it to preserve, to strengthen its own organizations. The government urges it, not only to make its voice heard now, but to take serious counsel regarding the future.

This work has begun. Parliaments of business are gathering daily at Washington. Upon the calendar of their deliberations is written: First, how can we help win the war? Secondly, what is our program, once the day of victory has come?—*Harry A. Wheeler in the National Business for August.*

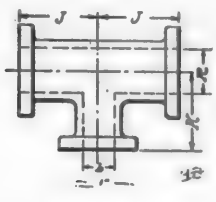
Deaths.

WILLIAM A. MYLER, secretary-treasurer of Standard Sanitary Mfg. Co., Pittsburgh, Pa., died at his summer home, Patterson Heights, Pa., July 25, after several months' illness. He was 66 years old. Mr. Myler was one of the organizers of the Standard Sanitary Mfg. Company and was prominent in Pittsburgh social and philanthropic circles.

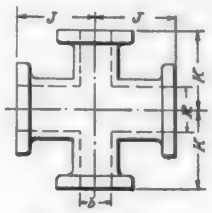
P. FRANCIS CORCORAN, secretary of the Hoffman Specialty Co., Chicago, died July 30 at the American Hospital, Chicago, following an operation for appendicitis. Mr. Corcoran was but 26 years old, but had already made a place for himself as an executive of ability and was a well-known figure in Chicago heating trade circles. He had been connected with the Hoffman Specialty Company since 1913.

Errata.

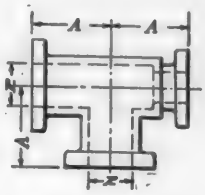
The attention of readers is called to a transposition of illustrations in Standard Data Sheet No. 17-D (published in the August, 1918, issue) listing "Standard Bull-Head Reducing Tees and Crosses, Flanged." These illustrations are reproduced herewith in their correct order.



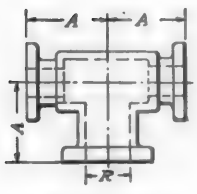
Reducing Tee.



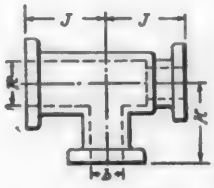
Reducing Cross.

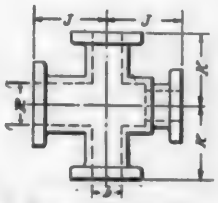


Reducing-on-Run Tee.



Bullhead Tee.





Reducing-on-Run and Branch Tee and Cross.

Keep Your Liberty Bonds

HOLD to that bond. You invested to help send the boys across. They are over now, at grips with the German monster. You expect them to hold on—hold on till the last vestige of autocracy is crushed out of him. Then you, too, must hold on—must keep your enlisted dollars invested on the fighting line.

It isn't the hooray of a campaign that wins a war. It's the will to hang on, to make sacrifice today, that tomorrow may bring victory.

And your investment. Those bonds are the safest investment you ever made. Don't be lured into exchanging them for the "securities" of some suave get-rich-quick operator. Big returns may be promised but the bigger the promised returns the bigger the risk.

If you have to have money, take your bond to any bank and use it as collateral for a loan. There is no security the banker would rather have—nothing on which he will lend more willingly.

Don't use bonds to buy merchandise. The average merchant, accepting your bond in trade, sells them immediately, thus tending to lower their market price and taking away from the buyer of your bond the ability to lend a corresponding amount of money to his Government. Liberty Bonds are meant to help your country at War; are meant for investment and to provide an incentive for saving and a provision for the rainy day.

Hold fast to your Liberty Bonds. Hold fast for the sake of the boys "Over There." Hold fast because it is good business.

UNITED STATES TREASURY DEPARTMENT

Contributed through Division of Advertising

United States Gov't Committee on Public Information

This space contributed for the winning of the war by

THE HEATING AND VENTILATING MAGAZINE

SIZING OF DUCTS AND FLUES—METHOD NO. 7.

(B. F. Sturtevant Co.)

NOTE.—For explanation and example assumed see Standard Data Sheets Nos. 10-M and 10-N.

The Sturtevant Co. uses a method of sizing ducts and flues based on equivalent pipes—usually 5-in. pipes being used. For school house and public building work velocities are used ranging from 1000 ft. per minute minimum to 1500 ft. per minute maximum. For the example here assumed a velocity at the fan of 1000 ft. per minute has been adopted, although for factory buildings this velocity is increased to 2000 to 2400 ft. per minute.

In this system there are sixteen outlets each to deliver 1500 C.F.M. This gives a total volume of 24,000 C.F.M. With a velocity of 1000 ft. per minute, the area of the pipe at the fan outlet would be 24 sq. ft., or 3456 sq. in. The next size round pipe to this would be 66 in. in diameter. In practice a pipe is used whose diameter is an even number of inches, that is, fractional sizes are disregarded. While not absolutely accurate, this method is close enough because two different men, building the same size of pipe would vary the friction considerably, depending upon the care which they used in forming the joints.

The equivalent 5-in. pipes for ducts and flues of various diameters shown herewith in Table I.

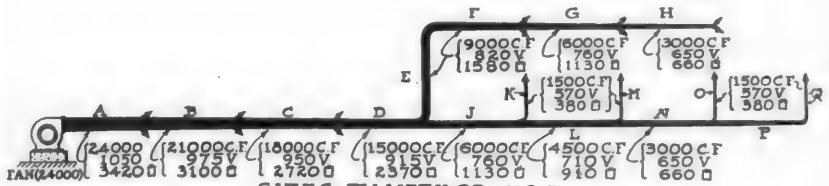
TABLE

Diam. of Pipe In.	Equiv. 5in. diam. Pipes	Diam. of Pipe In.	Equiv. 5in. diam. Pipes	Diam. of Pipe In.	Equiv. 5in. diam. Pipes	Diam. of Pipe In.	Equiv 5in. diam Pipes
5	1	29	79	53	365	77	931
6	1.6	30	88	54	378	78	961
7	2.3	31	96	55	400	79	992
8	3.2	32	103	56	414	80	1024
9	4.3	33	109	57	444	81	1056
10	5.7	34	119	58	458	82	1089
11	7	35	127	59	475	83	1122
12	9	36	138	60	499	84	1156
13	11	37	146	61	514	85	1191
14	13	38	157	62	538	86	1226
15	16	39	170	63	560	87	1262
16	18	40	179	64	587	88	1298
17	21	41	191	65	604	89	1336
18	24	42	204	66	630	90	1374
19	28	43	215	67	658	91	1413
20	32	44	228	68	678	92	1452
21	35	45	240	69	708	93	1492
22	41	46	253	70	730	94	1532
23	47	47	260	71	763	95	1573
24	50	48	282	72	786	96	1615
25	55	49	298	73	814	97	1657
26	62	50	316	74	843	98	1707
27	68	51	329	75	871	99	1744
28	74	52	349	76	901	100	1788

SIZING DUCTS AND FLUES—SEVENTH METHOD (Continued)

From this table it is seen that a 66-in. pipe is equivalent to 630-5-in pipes. 24,000 C.F.M. ÷ 630 = 38 cu. ft. per 5-in. pipe, equivalent to 1500/38 = 39.5 5-in. pipes, the required size of each outlet. From the table it is seen that it is very nearly equal to a 22-in. pipe. The equivalent number of 5-in. pipes for two outlets would be 79; for 3 outlets, 118½; for 4 outlets, 158; for 5 outlets, 197½; for 6 outlets, 237. for 7 outlets, 276½; for 8 outlets, 316; for 9 outlets, 355½; for 10 outlets, 395; for 11 outlets, 434½; for 12 outlets, 474; for 13 outlets, 513½; for 14 outlets, 553; for 15 outlets, 592½.

This gives a schedule of duct and flue sizes as follows:



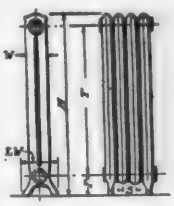
SIZES BY METHOD NO. 7

Duct or Flue	Length	Cu. Ft. per Min.	Dia. In.	Area Sq. In.	Velocity Ft Per Min.
A	Immaterial	24000	66	3420	1050
B	"	21000	63	3100	975
C	"	18000	59	2720	950
D	"	15000	55	2370	915
E & F	"	9000	45	1580	820
G & J	"	6000	38	1130	760
H	"	3000	29	660	650
L	"	4500	34	910	710
N	"	3000	29	660	650
K-M-O-Q	"	1500	22	380	570

All outlets 22 in. in diameter.

UNITED STATES RADIATOR COMPANY'S ONE-COLUMN FLORENTINE RADIATORS FOR STEAM AND WATER.

Number of Sections	*Length Inches	Heating Surface 38 Inch Height 2 Square Feet per Section	32 Inch Height 2½ Square Feet per Section	26 Inch Height 2 Square Feet per Section	22 Inch Height 1¾ Square Feet per Section	20 Inch Height 1½ Square Feet per Section
2	5	6	5	4	3½	3
3	7½	9	7½	6	5	4½
4	10	12	10	8	6¾	6
5	12½	15	12½	10	8½	7½
6	15	18	15	12	10	9
7	17½	21	17½	14	11¾	10½
8	20	24	20	16	13½	12
9	22½	27	22½	18	15	13½
10	25	30	25	20	16¾	15
11	27½	33	27½	22	18½	16½
12	30	36	30	24	20	18
13	32½	39	32½	26	21¾	19½
14	35	42	35	28	23½	21
15	37½	45	37½	30	25	22½
16	40	48	40	32	26¾	24
17	42½	51	42½	34	28½	25½
18	45	54	45	36	30	27
19	47½	57	47½	38	31¾	28½
20	50	60	50	40	33½	30
21	52½	63	52½	42	35	31½
22	55	66	55	44	36¾	33
23	57½	69	57½	46	38¼	34½
24	60	72	60	48	40	36
25	62½	75	62½	50	41¾	37½



Note—Add 1/2 in. for each bushing to get total length of radiator.
H = Total overall height.
T = C. to C. of tappings.
F = Floor to center of bottom tapping.
W = Width of radiator—4 1/2 in.
LW = Width of radiator legs—5 1/32 in.
S = Width of radiator sections, i. e., C to C of sections—2½ in.

Nominal Height of Radiator In.	Actual Height H In.	Steam Supply and Return F In.	Steam Supply and Return T In.	Water Supply and Return F In.	Water Supply and Return T In.
38	38	4	31 9/16	4 1/2	31 1/16
32	32	4	25 9/16	4 1/2	25 1/16
26	26	4	19 5/8	4 1/2	19 1/8
22	22	4	15 5/8	4 1/2	15 1/8
20	20	4	13 3/4	4 1/2	13 1/4

For high legs F. equals 6 in. and H. is increased 2 in. for steam or 1 1/2 in. for water.
For legless radiators deduct 2 1/2 in. from F. and H.

TAPPING DATA

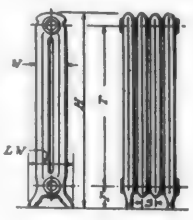
All radiators are tapped 2 in. and bushed as follows:

SYSTEM	Size of Radiator Square Feet	Supply In. Diam.	Return In. Diam.
Steam, one-pipe	Up to 24 sq. ft., inc.	1	
	Over 24 up to 60 inc.	1 1/4	
	Over 60 up to 100 inc.	1 1/2	
	Above 100 sq. ft.	2	
Steam, two-pipe	Up to 48 sq. ft. inc.	1	3/4
	Over 48 up to 96	1 1/4	1
	Above 96 sq. ft.	1 1/2	1 1/4
Water	Up to 40 sq. ft. inc.	1	1
	Over 40 up to 72 inc.	1 1/4	1 1/4
	Above 72 sq. ft.	1 1/2	1 1/2

All air valve tappings are 1/8 in.
Vapor tappings as instructed only.
All tappings with R. H. threads unless otherwise ordered.

UNITED STATES RADIATOR COMPANY'S TWO-COLUMN FLORENTINE RADIATORS FOR STEAM AND WATER.

No. of Sections	*Length Inches	Heating Surface: 45 Inch Height 5 Sq. Feet per Sect'n	38 Inch Height 4 Sq. Feet per Sect'n	33 Inch Height 3¼ Square Feet per Section	28 Inch Height 2¾ Square Feet per Section	23 Inch Height 2¼ Square Feet per Section	20 Inch Height 2 Square Feet per Section
2	5	10	8	6⅝	5½	4½	4
3	7½	15	12	10	8	6¾	6
4	10	20	16	13½	10⅝	9	8
5	12½	25	20	16⅝	13½	11¼	10
6	15	30	24	20	16	13½	12
7	17½	35	28	23⅓	18⅝	15¾	14
8	20	40	32	26⅔	21⅓	18	16
9	22½	45	36	30	24	20¼	18
10	25	50	40	33½	26⅔	22½	20
11	27½	55	44	36⅔	29⅓	24¾	22
12	30	60	48	40	32	27	24
13	32½	65	52	43⅓	34⅔	29¼	26
14	35	70	56	46⅔	37⅓	31½	28
15	37½	75	60	50	40	33¾	30
16	40	80	64	53⅓	42⅔	36	32
17	42½	85	68	56⅔	45⅓	38¼	34
18	45	90	72	60	48	40½	36
19	47½	95	76	63⅓	50⅔	42¾	38
20	50	100	80	66⅔	53⅓	45	40
21	52½	105	84	70	56	47¼	42
22	55	110	88	73⅓	58⅔	49½	44
23	57½	115	92	76⅔	61⅓	51¾	46
24	60	120	96	80	64	54	48
25	62½	125	100	83⅓	66⅔	56¼	50



Note—Add 1/2 in. for each bushing to get total length of radiator.
H = Total over all height.
T = C. to C. of tappings.
F = Floor to center of bottom tapping.
W = Width of radiator—7 1/8 in.
LW = Width of radiator legs—7 13/32 in.
S = Width of radiator sections, i. e., c. to C. of sections—2 1/2 in.

Nominal Height of Radiator In.	Actual Height H In.	Steam Supply and Return F	Steam Supply and Return T	Water Supply and Return F In.	Water Supply and Return T In.
45	45	4	38 3/8	4 1/2	37 7/8
38	38	4	31 9/16	4 1/2	31 1/16
32	32	4	25 9/16	4 1/2	25 1/16
26	26	4	19 5/8	4 1/2	19 1/8
22	22	4	15 5/8	4 1/2	15 1/8
20	20	4	13 11/16	4 1/2	13 3/16

For high legs F equals 6 in. and H. is increased 2 in. for steam or 1 1/2 in. for water.
For legless radiators deduct 2 1/2 in. from F. and H.

TAPPING DATA

All radiators are tapped 2 in. and bushed as follows:

SYSTEM	Size of Radiator Square Feet	Supply In. Diam	Return In. Diam.
Steam, one-pipe	Up to 24 sq. ft., inc.	1	
	Over 24 up to 60 inc.	1 1/4	
	Over 60 up to 100 inc.	1 1/2	
	Above 100 sq. ft.	2	
Steam, two-pipe	Up to 48 sq. ft. inc.	1	3/4
	Over 48 up to 96 inc.	1 1/4	1
	Above 96 sq. ft.	1 1/2	1 1/4
	Up to 40 sq. ft. inc.	1	1
	Over 40 up to 72 inc.	1 1/4	1 1/4
	Above 72 sq. ft.	1 1/2	1 1/2

All air valve tappings are 1/8 in.
Vapor tappings as instructed only.
All tappings with R. H. Threads unless otherwise ordered.

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

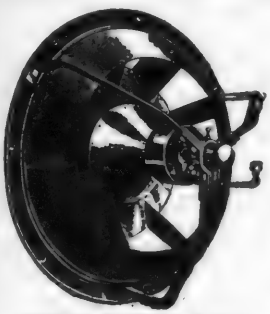
Charles H. Simmons, of the John Simmons Co., New York, has been accorded special recognition in the *Pioneer Bulletin,* issued by the War Savings Committee of New York, for his efforts in the sale of war savings stamps as chairman of the Iron Division. The John Simmons Company was the first firm in his division to secure the honor flag. Among those specially prominent as Mr. Simmon's assistants in this work was Charles G. Cornell, Jr., of Cornell & Underhill, New York.

Tokio, Japan.—An important new engineering firm has been formed in Tokio, Japan, known as the Takasago Engineering Works, Ltd. Among the principals are Shozo Saito, who is well-known to American heating engineers and manufacturers of heating apparatus.

Tulsa, Okla.—Orders have been issued by the city commissioners of Tulsa to the effect that all garages in the city will be compelled to install hot water or steam heating systems for the coming winter. The danger of fire from gasoline explosions through the use of open front heaters is given as the cause of the order.

Fort Des Moines, Ia.—Construction of a number of new buildings, remodeling and enlarging of old structures, and the installation of a central heating plant are among the improvements contemplated for the base hospital at Fort Des Moines. Major T. F. Laist of the construction division of the quartermaster's corps will have charge of the improvements.

Chicago, Ill.—The Chicago heating contractors have recently united in bearing the expense of an advertisement in one of the



DUPLEX CONE FAN
Belt Driven

HOWARD & MORSE
45 FULTON ST., N. Y.
Ventilating Engineers and Contractors
MANUFACTURERS OF
BLACKMAN and DUPLEX CONE FANS
which are installed by us complete with **Motors, Duct Work** and **Wiring.**

Aligning, Rigging and **Hoisting** done, with labor thoroughly qualified from long experience.

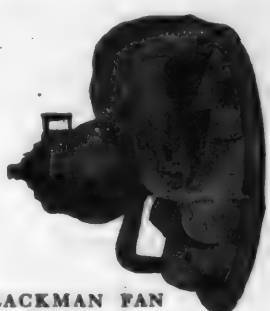
We make a specialty of **Kitchen Exhaust** work. Prominent buildings, hospitals, theatres, and private residences are among our many and recent installations.

The **Duplex Cone** Fans are semi-conoidal fans, made especially to operate against pressure in duct systems.

The **Blackman** Fans are used for fresh air delivery and in duct systems, when no great pressure is involved.

You can have the advantage of our experience.

SEND FOR CATALOGUE



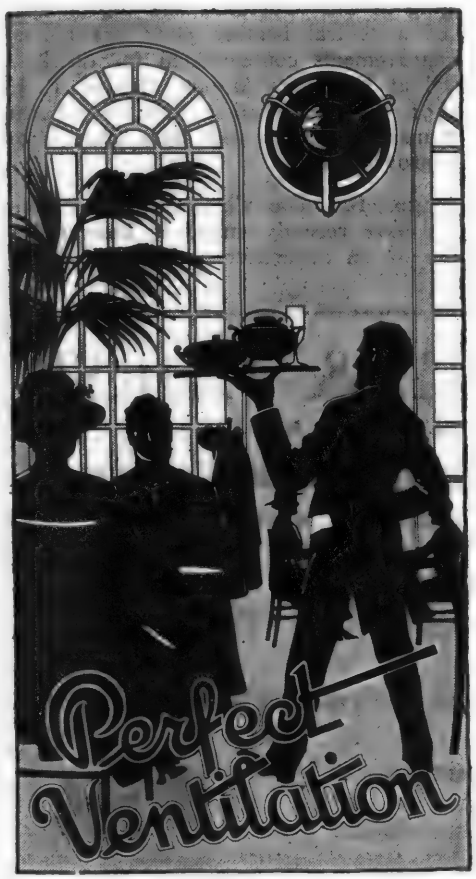
BLACKMAN FAN
Direct Connected to Motor

Chicago daily papers, which reproduces the following resolution adopted at a recent meeting of the Chicago Association of Master Steam Fitters:

"Whereas, it has been ascertained by careful comparisons covering a period of nearly twenty (20) years that the cost of heating installation, both of steam and water, has increased from the low point of about June 1 very considerably until December 1;

"Therefore, in view of this fact, and also of the difficulty of obtaining sufficient material and labor, the Chicago Master Steamfitters' Association recommends that such of the public who contemplate installing heating systems or making alterations in their present heating equipment this year, *do so at once.*"

Building Permits for July, 1918, in 140 cities, as compiled by the *American Contractor,* Chicago, totalled $41,809,299, compared with $57,095,689 for July, 1917, a decrease of 36%. The permits issued covered many factory additions necessitated by war work, and housing needs for war workers. Chicago made a notable return, due to government work, of $4,885,600 an increase of 16% over last year's figures. Dayton showed an increase of 25%. New York's total was $5,709,523 as compared with $5,950,542 in



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SELF-COOLED MOTOR PROPELLER FANS

Can be used for...

COOLING
VENTILATING
DRYING
EXHAUSTING

2000 SELF-COOLED MOTOR PROPELLER FANS IN STOCK FOR QUICK SHIPMENTS.

"IF IT'S SELF-COOLED IT'S AN ILG"

ILG ELECTRIC VENTILATING CO.
158 WHITING ST., CHICAGO, ILL.
Branches—All Large Cities

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

DETROIT PACKLESS RADIATOR VALVES

The Correct Radiator Valve for Vapor Heating

The Detroit Packless Vacu Valve is a Graduated Valve for Vapor and Vacuum Systems of Heating. The dial plate is provided with a series of holes and a movable pin. This pin acts as a stop for the handle pointer and is inserted in the hole in the dial nearest the point at which the valve, when opened, admits only sufficient vapor or steam to fully supply the radiator.

DETROIT PACKLESS
Vacu Valve showing Dial Plate and Lever Handle

Booklet VP-1 Gladly Sent Upon Request

DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

July, 1917. In Philadelphia the decrease was 78%, from $5,195,365 to $1,141,045.

American Association of Engineers has appointed C. E. Drayer as national secretary of the association. He took up his duties August 15. Mr. Drayer, who is a well-known Cleveland engineer, formulated the plan of combining the membership of the American Association of Engineers and the Cleveland Engineering Society which has already had a notable effect on engineering organization.

Shigeyuki Kitaura, mechanical engineer for the Department of Finance of the Japanese government, who has been in the United States during the past year studying American methods, sailed for Japan from Seattle September 14. During his stay in this country Mr. Kitaura met many prominent heating and ventilating engineers and manufacturers and was a frequent visitor at the office of THE HEATING AND VENTILATING MAGAZINE. Immediately upon his arrival in Japan he will take up the design for the new buildings for the Japanese Senate and House of Representatives which will be mechanically heated and ventilated. He will also have charge of the construction of the government-controlled tobacco factories, as well as of salt and camphor factories which are indirectly controlled by the government. Mr. Kitaura states that the superiority of the American product, both as to fans and blowers and boilers, as well as other apparatus, will make their use certain in government work in Japan.

Central Station Heating Notes.

Terre Haute, Ind.—The Citizen's Mutual Heating Company has filed a petition with the public service commission of Indiana for a new rate for the coming heating season. The rate granted to the company several years ago is 20 cents per square foot per season up to 3000 sq. ft. but last Fall, on account of the increased cost of fuel and labor, the commission added a special surcharge of 7 cents. The company's new petition asks for a surcharge of 8 cents, making a total of 28 cents per square foot up to 3000 sq. ft.; 27 cents from 3000 to 4000 sq. ft. and 25 cents for 4000 sq. ft. and over, or an increase of one cent per square foot over last year.

Great Falls, Mont.—The Montana Power

A Symbol and Its Significance

The JSC Symbol

It stands for the **Johnson Service Company,** the largest Heat Regulation Company in the World.

It is the largest because J S C System represents the highest development of heat control, because in the performance of its contracts J S C has always been accurate, prompt and conscientious.

The J S C symbol stands for satisfactory service always. It means that you, Mr. Engineer, and the Architect and the owner will get the best service at our disposal. Inquiries promptly answered. Offices in all principal cities.

The Johnson Service Co.
Milwaukee, Wis.

Company has submitted a petition to the public utilities commission asking to be permitted to discontinue its district heating system in Havre. According to the testimony submitted at a hearing on the petition, the company ran at a loss last season of $14,000.

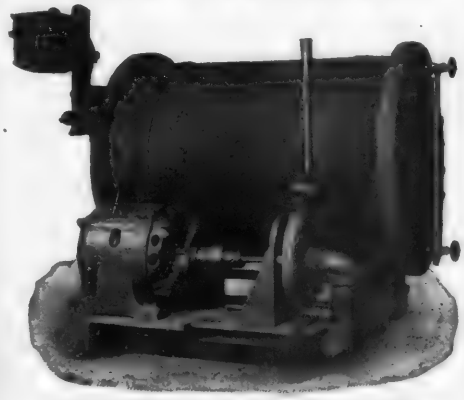
Billings, Mont.—The State Utilities Commission has ordered an increase in the rates charged by the Billings Utility Company of 2 cents per square foot of radiation per season. The order further directs that after September 1 the company shall invoice all heat furnished to the city hall and public library of Billings at the regular authorized schedule of rates and credit the full amount collected to the earnings of the utility. These buildings have been obtaining free heat and the commission holds this has been discriminatory in that the patrons have been penalized for service that should be borne by the entire city.

Last year the company applied for an increase of 7 cents per square foot of radiation per season. At a hearing held in Billings in August, 1917, sufficient evidence was brought out to show the company was entitled to immediate relief and an emergency order was made increasing the rates 5 cents.

Another hearing was held and it was shown the estimated operating expenses of

WAR-TIME ECONOMY

demands the use of fuel-saving devices



ARCHITECTS AND ENGINEERS

designing new plants generally provide for economical equipment, but there are many existing low pressure steam heating plants where a surprising amount of fuel could be saved by the installation of

Yeomans Electrically Operated Condensation Return Pumps

Made in Horizontal and Vertical Types for automatic operation

Send for Bulletin C-5000. Agents in all principal cities.

YEOMANS BROTHERS CO.
223 Institute Pl. Chicago, Ills.

They Never Need Attention

FIVE minutes to regulate a radiator trap doesn't sound very costly. But if there are 500 traps in the building, and each needs attention, then it's over 40 hours' time—and it comes right out of your profits.

That's just one of the ways you save money by installing Johns-Manville Radiator Traps. No valve, seat, or thermostatic adjustments required or possible, and chances for trouble are cut to the limit. No expanding liquids, no springs, no restricted air passage; no steam leakage or air binding.

Just three parts—body, ball and connection union. Nothing to wear out—nothing to be tampered with. Its record in service will give you some new ideas on trap economy. Better get the details.

H. W. JOHNS-MANVILLE CO.
New York City

10 Factories—Branches in 61 Large Cities

Johns-Manville Radiator Trap

the company for the 1918-1919 season will be $60,000 and its income $61,405.70, and as this income is deemed insufficient, the commission now grants another increase of 2 cents.

Anderson, Ind.—A proposition to furnish Anderson with electric current at the actual cost of production has been made by the Central Heating Company. The proposition involves the removal of one of the turbines from the municipal plant to the heating plant, the company agreeing to furnish electricity to the city at the actual cost of production at the municipal plant.

Manufacturers' Notes.

Farnsworth, Co., Conshohocken, Pa., has concluded a selling arrangement with Fairbanks, Morse & Co., for the Pacific Coast agency for the Farnsworth line of steam pumps, traps and other steam specialties.

Pressed Steel Car Co., Pittsburgh, Pa., has appointed A. C. Edgar of Philadelphia, as one of its shop superintendents in charge of work for the Emergency Fleet Corporation. Mr. Edgar is a charter member of The American Society of Heating and Ventilating Engineers.

Bishop & Babcock is the new name that has been adopted by the Bishop-Babcock-Becker Co., Cleveland, O., manufacturers of the Reliable heating systems.

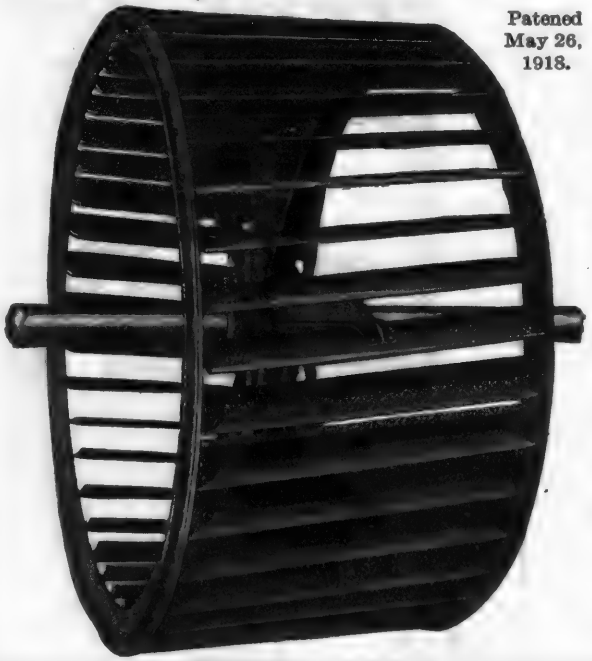
J. B. Wise, Inc., Watertown, N. Y., has appointed E. W. Sanborn as the company's representative for Chicago and vicinity, with headquarters at 322 South Michigan Ave., Chicago.

Standard Sanitary Mfg. Co., Pittsburgh, Pa., announces the election of Samuel H. Moon as secretary-treasurer of the company succeeding the late W. A. Myler. Mr. Moon was previously general manager of the Ahrens & Ott division of the Standard Sanitary Mfg. Company. He has been succeeded in that position by J. W. Oliver, sales manager of the Ahrens & Ott division in Louisville.

American Radiator Co., Chicago, Ill., has declared its regular quarterly dividend of 3% on its common stock, payable September 30, and 1¾% on the preferred stock payable August 15.

THIS IS WHAT WE HAVE BEEN "BLOWING" ABOUT!

THE NEW IMPROVED **Cycloidal Multivane Wheel**



Patened May 26, 1918.

For Heating and Ventilating

The vanes are curved forward, and set at an angle to the shaft, (patented feature) allowing uniform, unrestricted flow of air across entire width of wheel.

Highest Efficiency

Noiseless and Durable

Write for further details

Garden City Fan Co.

Est. 1879

CHICAGO, ILL.

Eastern Representatives:
L. J. WING MFG. CO., New York

"Sirocco"

TRADE MARK

Speeds Up Production

In these days of rush work, with everything strained to the limit, fresh pure air for the factory is of vital importance.

The Sirocco System of Heating and Ventilating is used by many of America's best known and most successful manufacturers.

The view above shows an installation in a factory noted for its production and efficiency methods.

In the "dog days" of summer the Sirocco System is invaluable in keeping the factory workers fresh and fit by supplying the proper amount of fresh, pure air to every nook and corner.

Let us tell you more about Sirocco for your factory—Ask for Bulletin No. 270.

American Blower Company

DETROIT, MICHIGAN

BRANCHES IN ALL PRINCIPAL CITIES

Batterman-Truitt Co., Chicago, Ill., has elected T. F. Le Jeune as secretary-treasurer of the company. Mr. Le Jeune was formerly general manager of the Electric Appliance Co., Chicago.

Nash Engineering Co., South Norwalk, Conn., manufacturers of vacuum and low-pressure boiler-feed pumps, announces the removal of its New York office to 21 East 40th St. H. M. Wylie is in charge of the New York office.

Gem City Boiler Co., Dayton, O., announces that its entire capacity is taken up at present on a contract for fabricating ship plates for the Government.

Batterman-Truitt Co., Chicago, Ill., manufacturers and installers of motor-driven propeller fans, blowers and louvres, has increased its capital stock to $30,000 to take care of its rapidly-growing business. Five months ago the company moved into its present larger quarters at 736-738 West Monroe Street, tripling its facilities and equipment. The present officers of the company are: President, Joseph E. Truitt; vice-president, E. Ackerman; secretary-treasurer, Theodore F. LeJeune. The company announces that owing to the fact that its Cleveland representative, Leland Green, is going into the army service, the Cleveland branch will be in charge of E. R. Morrison, operating under the name of the Industrial Equipment Co., 919 American Trust Building, Cleveland.

Wm. H. Page Boiler Co., New York, reports a recent order from Tokio, Japan, for eight down-draft smokeless boilers of various sizes, ranging from 3000 to 7500 sq. ft., and another order from Tientsin, China, for two such boilers.

Sarco Co., New York, manufacturer of the Sarco line of thermostatic radiator traps, steam traps and temperature regulators has opened a new office in Atlanta, Ga., in the Healey Building, the new branch will be under the management of C. R. Dunwody.

Allied Industries Corporation Acquires Grand Central Palace in New York.

Announcement is made that the Allied Industries Corporation, of which Alfred I du Pont is president, has acquired the Grand Central Palace in New York, for the purpose of establishing a point of contact between commercial United States and the rest of the world in the development of

AUTOVENT LOUVRES

LOUVRE CLOSED

LOUVRE OPENED

The above cuts illustrate our Autovent Louvre Dampers, such as used in conjunction with fan and blower installations to provide weather protection to fan outlets when fan is not in operation.

BLADES of standard louvres are constructed of galvanized iron, the pivot rods as well as all working parts being made of brass and not subject to corrosion or wear, also they are not affected by moisture.

SPECIAL LOUVRES equipped with copper blades can be furnished where fans handle acids.

ALL SIZES CARRIED IN STOCK FOR QUICK SHIPMENTS

Manufactured by

BATTERMAN TRUITT CO., 736-38 W. Monroe St., CHICAGO, ILL.

Cleveland Office, 919 American Trust Bldg. Philadelphia Office: W. I. Cheyney, Heed Bldg.

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Successful Use Tells the Story

BAETZ
HEATING SYSTEMS

are not an experiment. They are giving satisfactory use in hundreds of installations.

The Ideal Unit Heating System
ECONOMICAL and SIMPLE

We welcome the fullest investigations of our claims and records of many years' service

Send for latest catalogues containing photographs of typical installations in various types of buildings

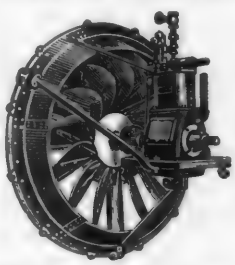
SKINNER BROS. MFG., CO.
ST. LOUIS, MO.

Sole Manufacturers and Distributors of Baetz Heating Systems.

JAMES M. SEYMOUR
NEWARK - NEW JERSEY - U. S. A.

ELECTRIC DRIVEN

STEAM DRIVEN



BELT DRIVEN

Send for Bulletin No. 121, Jan. 1917

SEYMOUR FANS are the most durable and efficient air moving machines to be had in this country. Built in seven styles and fifteen sizes, 18-inch to 168-inch fans in stock. Capacity 1000 cubic feet to 150,000 cubic feet per minute.

Ventilating systems to suit all conditions. **Dust Collectors, Humidifiers, Dry-Rooms** to dry anything from bricks to sponges.

AIR CONDITIONING

JAMES M. SEYMOUR, 5-7-9-11-15-17-19 Kirk Place, NEWARK, N. J.

foreign trade. For the present, however, and probably until the close of the war the building will be used by the government for hospital purposes.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising architect, Treasury Department, for the following-named work:

Until September 16, 1918, for the mechanical equipment of the United States Marine Hospital at Stapleton, Staten Island, New York.

Work of United States Employment Service.

Attention is called by the Division of Engineering of the United States Employment Service to the fact that there is no necessity for the individual engineer to pay commissions to commercial agencies to get positions in shipyards and other war activities. A. H. Krom, director of the division, emphasizes the fact that the privileges of the division are open, free of charge, to all engineers and technical men. During July the division received 468 applications for help from employers, 1314 applications for help

Betson's Plastic Fire Brick comes in bulk, ready to use, and is simply hammered into place with a mallet and smoothed with a trowel.

Don't Wait for Fire Brick Blocks

Special fire brick blocks are scarce and are getting scarcer.

If you are waiting for blocks or tiles for relining, repairing, or any such purpose, give it up and immediately get Betson's Plastic Fire Brick instead.

Your own men can put in any form or shape of fire brick lining right in place, in one piece. After four or five hours of light heating the furnace is ready for use. It will not only save you delay now, but will protect against delay and interruption in the future.

Betson's is a mixture of the best fire clay, scientifically compounded and prepared mechanically so that it does not contract or expand. It is shipped in barrels in a soft, plastic condition ready for use. It is pounded into place with a mallet and smoothed with a trowel.

Plastic Fire Brick is Carried in Stock

in New York, San Francisco, Chicago, Philadelphia, Detroit, Cincinnati, St. Louis, Providence, Duluth, Kansas City, Denver, New Orleans, Toronto, etc.

Better Than Blocks

Betson's is far superior to blocks which require mortar joints, which are constantly falling out, which permit air inleakage, which crack and spall. Ordinary fire brick or block linings begin to fail first at the joints, due to crumbling of the fire clay mortar and local stresses. All this is eliminated with Betson's. Injuries to side walls by firing tools do not weaken the lining as a whole and are easily patched. Betson's is the most reliable and economical lining in the long run, as shown by the fact that large corporations are using it in increasing quantities. A dab on the end of a poker will often stop a hole in a lining and keep the boiler going.

Immediate deliveries from all warehouses

BETSON'S

REG. U.S. TRADE MARK PAT. OFF.

PLASTIC FIRE BRICK

Betson Plastic Fire Brick Co.

P. O. Box 6386

Rome, New York

New York Office: 30 Church St. 4

If You Have Not a Set of Our Catalogs, Get It Today

"CRESCENT"

Thermometers for all applications

GAUGES

"S&B"

Steam, Vacuum Compound, Altitude, etc.

COLUMBIA"

RECORDING THERMOMETER

It is more than a catalog—it is a text book on Instruments for Indicating and Reading Pressure, Vacuum Draft, Temperature, etc.

Write for Special Catalog Set HV Today

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"COLUMBIA"

RECORDING GAUGE

Also many other Allied Instruments, Gauge Boards and Complete Equipment

Hotel Pennsylvania

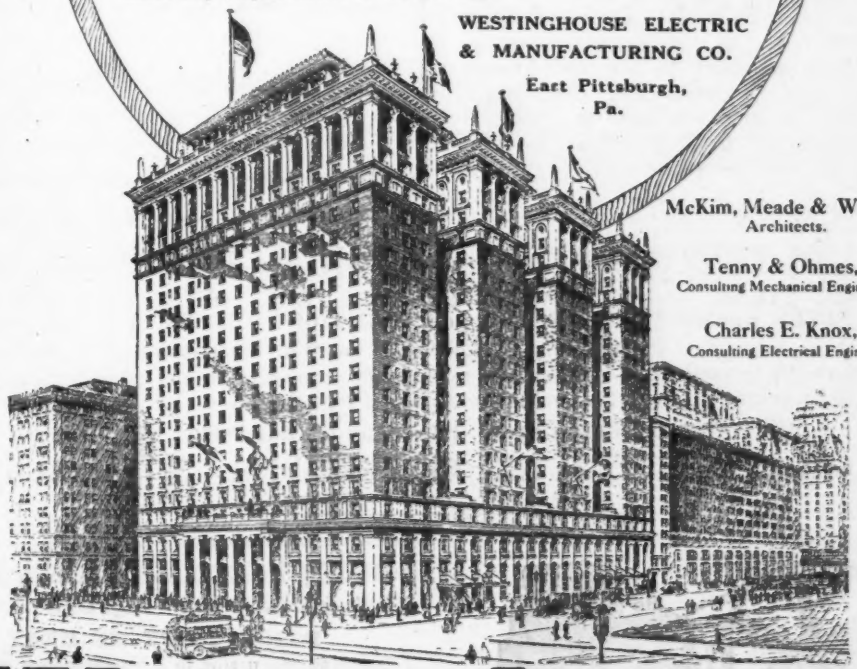
Westinghouse
Ventilating Motors and Control will be installed in
THE WORLD'S LARGEST HOTEL

Westinghouse was one of the first to recognize that the requirements of ventilating service demanded Motors and Control Equipments specially adapted to the service.

We give credit for the successful and extensive application of our equipment to our early efforts in determining definitely, by extensive shop and field tests, the correct basis for our design.

From our complete line, a motor and Control can be selected to meet any requirement of the service.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
East Pittsburgh, Pa.



McKim, Meade & White,
Architects.

Tenny & Ohmes,
Consulting Mechanical Engineers.

Charles E. Knox,
Consulting Electrical Engineer.

Westinghouse

from workers, has referred out 1063 applications and has actually located 483 men.

All that applicants for service need to do is to apply to the local branch of the United States Employment Service and they will obtain at once the help they need. For additional information and application blanks, they may apply at the central department, Division of Engineering, United States Employment Service, Chicago, Ill. Whether in need of war work or not, every engineer and technical man is urged to apply at once to these offices for registration blanks, so that he may put a record of his ability on file with the government and may thereby at any future date secure a position, without any charge whatever.

Carbocoal Receives Government Endorsement.

Recognition of the merits of the Carbocoal process, which produces a fuel said to be the equal in many respects of anthracite, has been accorded by the Government in its establishment of a by-product Carbocoal plant at Clinchfield, Va., in the southwest section of that State adjacent to the well-known Clinchfield coal regions. The new plant, which will be in operation early in 1919, will have a capacity of treating several hundred thousands tons of bituminous coal annually. It will eventually be enlarged to take care of 1,500,000 tons per year.

In appearance Carbocoal resembles compressed coke. It is produced from bituminous coal by a new method of coal distillation at relatively low temperatures in which there is simultaneously obtained from the coal a sufficient quantity of valuable coal tar products as to largely offset the cost of converting the raw coal into this refined smokeless product. These volatile hydrocarbon products, which are the smoke-producing elements in coal, include motor spirits, benzol, tuloul, naphthas, cresotes, tar acids, lubricating and fuel oils, ammonia and other products. In developing the Smith process,

Humidifying and Ventilating Systems with Automatic Control of Temperature and Humidity

With a vast experience in humidifying, ventilating and cooling work, this organization can readily suggest a solution to any difficult problem in air conditioning, and is in excellent position to cooperate with heating and ventilating engineers.

Carrier Engineering Corporation

39 Cortlandt Street, New York

Boston Philadelphia Buffalo Chicago

88

STANDARD THERMOMETERS --- INDICATING AND RECORDING

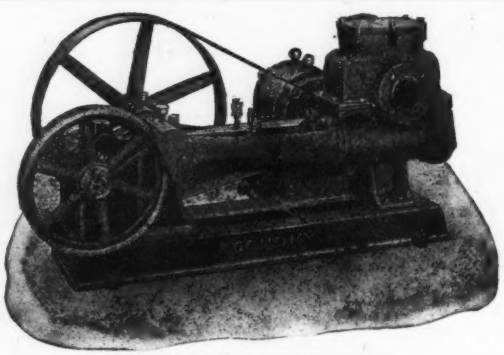
for VACUUM, STEAM and HOT WATER SYSTEMS, BAKE OVENS and COLD STORAGE PLANTS. SEVEN models of RECORDING and EIGHT of INDICATING Thermometers.

All Accurate, Durable and Legible. Backed by 30 years of Thermometer Manufacturing.

They are practically indestructible, are sensitive to changing temperatures and are very easily installed. Supplied with horizontal or vertical extension and standard pipe thread.

Ask for Catalog No. 100-107 and Trade Prices.

STANDARD THERMOMETER CO., 65 Shirley St., Boston, Mass.



This Outfit is Noiseless

Economy Return Line Vacuum Pumps

Electric or Power Driven High Class Bronze Fitted

PRICE CAN'T BE BEAT

Quantity production in specialized lines enables us to make prices that others making a large variety of apparatus cannot meet.

Keep in Step with the Times Be a Specialist

Buy your Return or Air Line Vacuum Pumps, Condensation or Hot Water Circulating Pumps from Manufacturers who specialize in pumps for the Heating Trade.

Don't fail to write for "ECONOMY MANUAL A." Most complete vest pocket Heating, Ventilating Engineer's Hand Book. This $1.00 publication mailed free on request.

ECONOMY PUMPING MACHINERY CO.

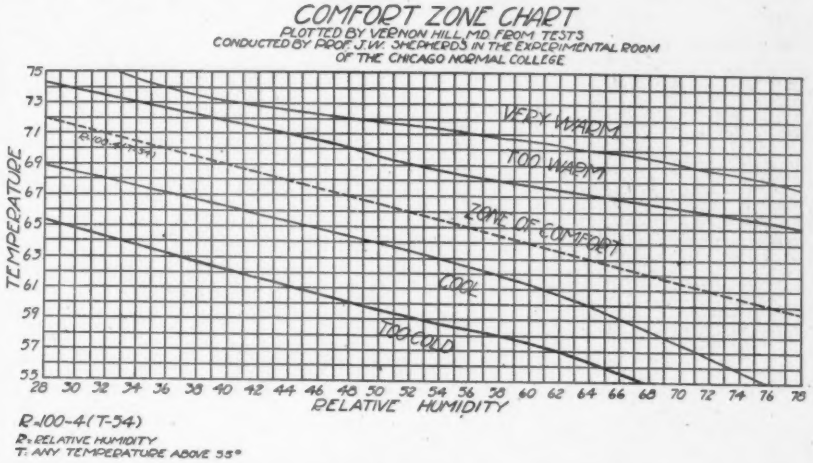
116-118 N. Carpenter St., Chicago, Ill.

THE WEBSTER AIR WASHER

when equipped with Automatic Humidity Control will maintain the condition of a properly ventilated building.

At the Comfort Zone

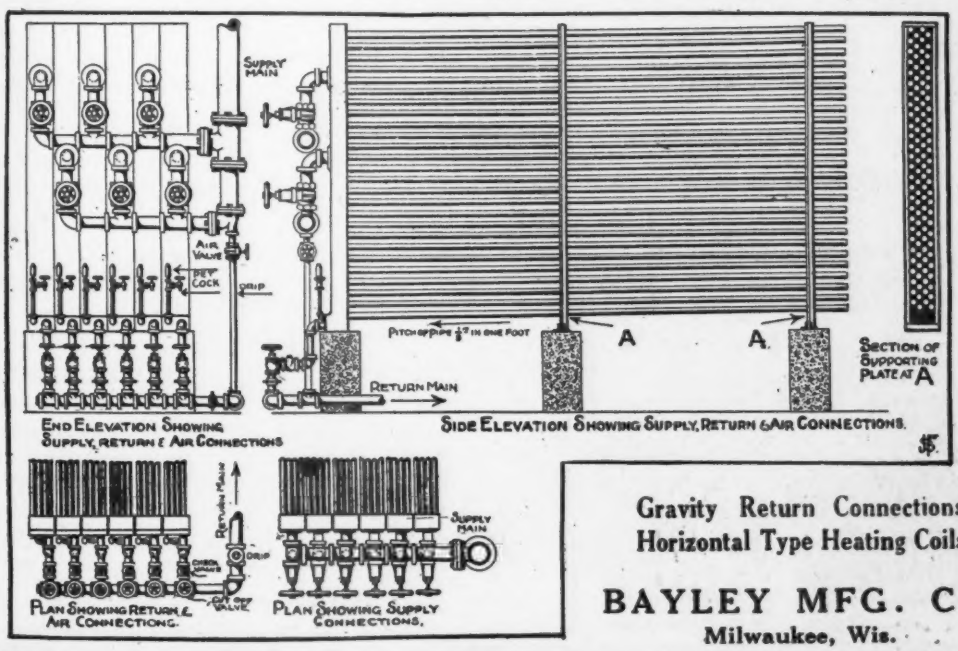
conserve the health of the employee, increasing efficiency.



BRAEMER AIR CONDITIONING CORPORATION, Lafayette Bldg., PHILADELPHIA, PA

CHINOOK HEATERS

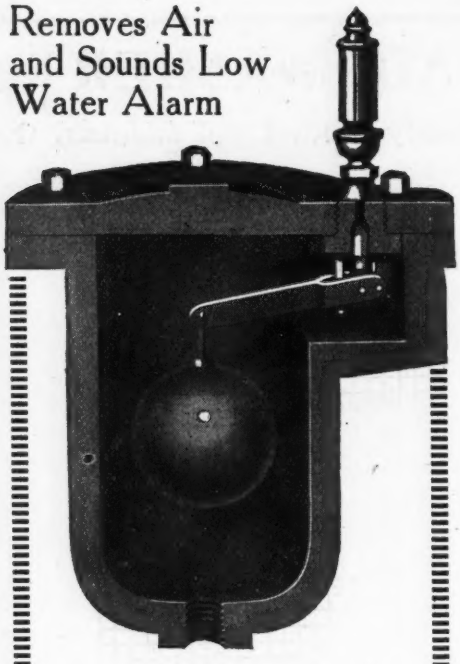
Give Positive Circulation No Unequal Expansion and Contraction. Highly Efficient



Gravity Return Connections
Horizontal Type Heating Coils

BAYLEY MFG. CO.
Milwaukee, Wis.

Removes Air
and Sounds Low
Water Alarm



IN addition to its wide application for removing air from water under pressure the

Wright
Air Trap

is especially adapted for taking air from closed water receivers, and sounding an alarm when the water in closed tanks reaches a lower point than is desired.

Size of Trap, 6 x 7; inlet, ¾ in.

Send for new catalog

WRIGHT-AUSTIN CO.
Detroit, U. S. A.

Branch Offices:
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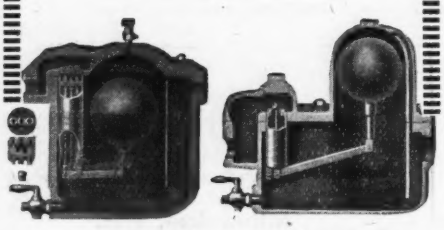
Representatives Everywhere



as it is known from the fact that the originator of the method is Charles H. Smith, a mining engineer, an experimental plant has been constructed at Irvington, N. J., where exhaustive tests under operating conditions have been made. The essential features of the process are the two distillations carried on at different temperatures, first of the raw coal, and, second, of the raw briquets. The raw coal, after being crushed, is distilled at a relatively low temperature from 850° to 900° F. and the volatile content is thereby reduced to the desired point. The result of this first distillation is a large yield of gas and tar and product rich in carbon termed semi-carbocoal.

The semi-carbocoal is next mixed with a certain proportion of pitch obtained from the tar produced in the process, and this mixture is briquetted. The briquets are then subjected to a higher temperature, approximately 1600° F., resulting in the production of carbocoal, the recovery of additional tar and gas, and a substantial yield of ammonium sulphate.

Carbocoal, it is stated, has been found to have the essential properties of a perfect fuel. It contains from 1½% to 4% of volatile matter and consists mainly of fixed carbon. In combustion it is described as smokeless, igniting with comparative ease, burning freely under all draft conditions, while it is dense, dustless, clean and uniform in size and quality. In Carbocoal, it is added distant consumers of anthracite may enjoy a smaller transportation expense and have an unlimited dependable supply. Without change of firebox or furnace, it is stated, Carbocoal responds more quickly to draft and produces quicker heat than can be obtained with anthracite.

This product is controlled by the International Coal Products Corporation, 24 Broad St., New York, and has the financial backing of Blair & Co., New York.

Smoke Prevention Association's Annual Convention.

The novel experience of holding its annual convention in the East was enjoyed by the Smoke Prevention Association which met this year in Newark, N. J., August 20-23. Among the papers presented was one by W. A. Pittsford of the Kewanee Boiler Company on "Burning Bituminous Coal Smokelessly." (reproduced in this issue).

The selection of Newark as the convention city was in compliment to Daniel J. Maloney, smoke inspector of Newark and first vice-president of the association. Warren A. Edson, chief smoke inspector of Boston, was elected president for the ensuing year.